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# **NAVAL POSTGRADUATE SCHOOL**

**MONTEREY, CALIFORNIA**

## **THESIS**

**A QUALITATIVE ANALYSIS OF THE NAVY'S HSI  
BILLET STRUCTURE**

by

Elizabeth A. Kratz

June 2008

Thesis Advisor:  
Second Reader:

William Hatch II  
Lawrence Shattuck

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<b>REPORT DOCUMENTATION PAGE</b>			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
<b>1. AGENCY USE ONLY (Leave blank)</b>		<b>2. REPORT DATE</b> June 2008	<b>3. REPORT TYPE AND DATES COVERED</b> Master's Thesis	
<b>4. TITLE AND SUBTITLE</b> A Qualitative Analysis of the Navy's HSI Billet Structure			<b>5. FUNDING NUMBERS</b>	
<b>6. AUTHOR(S)</b> Elizabeth A. Kratz				
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Naval Postgraduate School Monterey, CA 93943-5000			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> N/A			<b>10. SPONSORING/MONITORING AGENCY REPORT NUMBER</b>	
<b>11. SUPPLEMENTARY NOTES</b> The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for public release; distribution is unlimited			<b>12b. DISTRIBUTION CODE</b>	
<b>13. ABSTRACT (maximum 200 words)</b> This research was conducted in response to a request by Chief of Naval Personnel and examined the Navy's Human Systems Integration billet structure, the work requirements of the 4600 (Human Systems Integration) coded billets and the work done by officers who had a 4600 subspecialty code. The research results support the hypothesis that the work requirements of the July 2007 data set of 4600P-coded billets (billets requiring graduate education in Human Systems Integration) was not properly representative of the Human Systems Integration competencies as developed through the Educational Skill Requirements; not all Navy Human Systems Integration work was identified by a 4600 subspecialty; and the 4600 billet structure did not allow sufficient career progression opportunities. Despite the focus on the defense acquisition process in the Human Systems Integration curriculum at Naval Postgraduate School, the billets did not reflect this priority. In order for Human Systems Integration to be a viable subspecialty requiring graduate education, relevant billets need to be identified in the Navy. The research recommends conducting an in-depth needs analysis to better identify the Human Systems Integration work of the Navy by organization and subsequently leading to a better "fit" of officer category, designator, grade, education, and work experience.				
<b>14. SUBJECT TERMS</b> HSI, Human Systems Integration, NOBC, ESR, 1200, Billets, 4600, SSP, Subspecialty, Navy Human Resources, Manpower, Needs Analysis			<b>15. NUMBER OF PAGES</b> 99	
			<b>16. PRICE CODE</b>	
<b>17. SECURITY CLASSIFICATION OF REPORT</b> Unclassified	<b>18. SECURITY CLASSIFICATION OF THIS PAGE</b> Unclassified	<b>19. SECURITY CLASSIFICATION OF ABSTRACT</b> Unclassified	<b>20. LIMITATION OF ABSTRACT</b> UU	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)  
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**A QUALITATIVE ANALYSIS OF THE NAVY'S HSI BILLET STRUCTURE**

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Lieutenant, United States Navy  
B.S., Gordon College, 2001

Submitted in partial fulfillment of the  
requirements for the degree of

**MASTER OF SCIENCE IN HUMAN SYSTEMS INTEGRATION**

from the

**NAVAL POSTGRADUATE SCHOOL  
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## **ABSTRACT**

This research was conducted in response to a request by Chief of Naval Personnel and examined the Navy's Human Systems Integration billet structure, the work requirements of the 4600 (Human Systems Integration) coded billets and the work done by officers who had a 4600 subspecialty code. The research results support the hypothesis that the work requirements of the July 2007 data set of 4600P-coded billets (billets requiring graduate education in Human Systems Integration) was not properly representative of the Human Systems Integration competencies as developed through the Educational Skill Requirements; not all Navy Human Systems Integration work was identified by a 4600 subspecialty; and the 4600 billet structure did not allow sufficient career progression opportunities. Despite the focus on the defense acquisition process in the Human Systems Integration curriculum at Naval Postgraduate School, the billets did not reflect this priority. In order for Human Systems Integration to be a viable subspecialty requiring graduate education, relevant billets need to be identified in the Navy. The research recommends conducting an in-depth needs analysis to better identify the Human Systems Integration work of the Navy by organization and subsequently leading to a better "fit" of officer category, designator, grade, education, and work experience.

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## **EXECUTIVE SUMMARY**

This research was conducted in response to a request by Chief of Naval Personnel and examined the Navy's Human Systems Integration billet structure, the work requirements of the 4600 (Human Systems Integration) coded billets and the work done by officers who had a 4600 subspecialty code. The research results support the hypothesis that the work requirements of the July 2007 data set of 4600P-coded billets (billets requiring graduate education in Human Systems Integration) was not properly representative of the Human Systems Integration competencies as developed through the Educational Skill Requirements; not all Navy Human Systems Integration work was identified by a 4600 subspecialty; and the 4600 billet structure did not allow sufficient career progression opportunities. A quantitative analysis shows very few officers assigned to 4600-coded billets had either formal Human Systems Integration education or significant experience.

The Human Systems Integration billet base is shrinking from 45 billets in June 2007 to 17 billets by the end of the 2008 Fiscal Year. As of Fiscal Year 2009, the Human Performance Center will no longer be funded and as a result will be disestablished. The loss of the Human Performance Center removes twelve 4600P-coded billets. In February 2008, the Engineering Duty Officer community requested that the twelve 4600P (billets requiring graduate education in Human Systems Integration) and two 4600S (significant experience in Human Systems Integration without corresponding graduate education) subspecialty codes at Space and Naval Warfare Systems Command be replaced by Engineering Duty Officer approved subspecialties. In April 2008, the request was approved. In order for Human Systems Integration to be a viable subspecialty requiring graduate education, relevant Human Systems Integration billets need to be identified in the Navy.

Further examination showed inconsistencies in "proven specialist" requirements according to paygrade distribution. No Human Systems Integration billet requires an officer with a 4600Q code, which indicates a proven subspecialist with Human Systems Integration graduate education. To earn a 4600Q subspecialty, an officer must complete

Human Systems Integration graduate education to earn a “P” code and fill a 4600P-coded billet for at least 18 months. With the 4600Q subspecialty code, the officer would be qualified to fill 4600Q billets. However, no 4600Q billets exist in the July 2007 billet set. Thus, an officer cannot sufficiently progress in the 4600 subspecialty throughout the career. Senior officer Human Systems Integration billets should reflect a requirement for significant experience in Human Systems Integration.

No Navy Officer Billet Classification accurately represents the Educational Skill Requirements attained through graduate education or experience tours. Current Human Systems Integration billets have associated Navy Officer Billet Classifications that reflect a small subset of Human Systems Integration domains and competencies without the broader Human Systems Integration implications. Despite the focus on the defense acquisition process in the Human Systems Integration curriculum at Naval Postgraduate School, the billets did not reflect this priority. Human Systems Integration-specific Navy Officer Billet Classifications would help clarify the career progression and the Human Systems Integration contribution to an organization. The Navy Officer Billet Classifications reflected in the officer’s record would demonstrate the aspects of Human Systems Integration the officer has experienced.

The research concludes that officer career progression takes precedence over assignment of officers in graduate education utilization tours. No Human Systems Integration educated officers are filling 4600P-coded billets as of July 2007. Sea tours and department head tours take priority over subspecialty utilization. The youth of the Human Systems Integration program has not allowed officers to complete leadership tours after graduation and then complete follow-on tours in Human Systems Integration - coded billets.

The analysis shows that the Medical Service Corps has the largest number of officers with a 4600 subspecialty, but no Human Systems Integration billets required the Medical Service Corps designator. Two Medical Service Corps officers hold a 4600P code, 24 have earned a 4600S, and one has earned a 4600R code. By contrast, only 12 Human Resources officers have obtained a 4600P or 4600S code even though 19 of 45 Human Systems Integration billets (July 2007 data set) required HR officers. Billets in

the Medical Service Corps community should be examined for possible matches to Human Systems Integration competencies.

The research recommends conducting an in-depth needs analysis in order to better identify the Human Systems Integration work of the Navy by organization and subsequently leading to officer category, designator, grade, education, and work experience.

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## **ACKNOWLEDGMENTS**

I would like to thank my thesis advisor, CDR Bill Hatch, for his ongoing encouragement, advice, and guidance. I appreciate his dedication to instilling Manpower and Personnel concepts in me throughout the thesis process to further my understanding of Human Resources within the Navy.

I would like to thank my second reader, COL Larry Shattuck, for his help in the thesis process and his insights into the HSI work performed in the Navy.

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## **I. INTRODUCTION**

### **A. PURPOSE**

The purpose of this thesis is to conduct an analysis of the existing billet structure and of the Naval officers who have earned a 4600 subspecialty (SSP) code in Human Systems Integration (HSI). This chapter provides a brief background of HSI, HSI in the Department of Defense (DoD), the implementation of graduate education in HSI at the Naval Postgraduate School, and the structure of HSI billets.

### **B. THE BIRTH OF HUMAN SYSTEMS INTEGRATION**

Over the past 150 years, society has seen incredible gains in technology. From the cotton gin to the internal combustion engine to the airplane, the machine has supplemented and replaced many functions of the human. Most machines, however, need a human to operate, maintain, and sustain them.

The incongruous nature of the human-machine interaction came to a head during World War II when aircraft were increasingly being used to fight battles. Many aviation accidents were attributed to pilot error. For example, pilots and co-pilots of P-47s, B-17s, and B-25s frequently retracted the wheels instead of the flaps of the plane after landing. In 1943, a psychologist at Wright Field examined the accident reports and equipment and found that a confusing cockpit design led to pilot error: identical toggle switches for the wheels and flaps were side-by-side. After installing a small rubber tire to the wheel control and a wedged-shaped end to the flap control as mnemonic devices, this particular aviation mishap was eliminated (Roscoe, 1997).

Further research into the human-machine interaction led to the field of human factors engineering (HFE), which aims to improve performance, safety, and user satisfaction. HFE examines human sensation, perception, cognition, anthropometry, and biomechanics and the interaction of these factors with machine controls, displays, and workspace design. The human-machine interaction produces insight into human stressors, safety, training, and personnel selection and influences equipment design and procedure development (Shattuck, 2006). Christopher D. Wickens defines the “goal of human

factors as making the human interaction with systems one that enhances performance, increases safety, increases human satisfaction. Human Factors involves the study of factors and development of tools that facilitate the achievement of these goals” (Wickens, 2004).

Since World War II, the U.S. military has acquired thousands of new weapon systems and types of equipment. The inconsistent application of HFE to the new technology has led to problems with respect to combat effectiveness for the user and significant budget issues for the DoD. User issues have included safety, human survivability, health hazards, and habitability. DoD, meanwhile, has faced higher than expected costs and insufficient combat effectiveness brought about in part by needing specialized personnel for increasingly complex systems (US Army MANPRINT Directorate, 2000). Specialized personnel can be highly skilled or trained to operate complicated systems, fit the restrictive body dimensions that some systems require, and/or learn quickly to reduce training time. These requirements can increase personnel recruitment, selection, retention, and training costs. Demanding training requirements increase the time to prepare personnel who are ready to operate a system, which could reduce combat effectiveness during wartime when weapons may be produced faster than personnel can be trained to operate them.

The unintended consequences of technology on the domains of manpower, personnel, and training led the Army to establish the Manpower and Personnel Integration program (MANPRINT) in 1982. MANPRINT examines seven human-related domains throughout the acquisition process: manpower, personnel, training, human factors engineering, soldier survivability, system safety, and health hazards. MANPRINT objectives include integrating human performance concerns into every step of the materiel acquisition life-cycle. MANPRINT was the forerunner to the DoD-wide implementation of HSI (US Army MANPRINT Directorate, 2000).

### **C. THE DOCUMENTATION OF HSI**

Dr. Harold Booher, the first Senior Executive Director of MANPRINT, documented the Army’s approach to HSI in his 1990 book *MANPRINT: An Approach to*

*Systems Integration*. In 2003, Booher presented a broader view of HSI in the *Handbook of Human Systems Integration*, which applied to all the Armed Services and the private sector. Booher proposed that a master's degree program be created to educate HSI practitioners. He outlined an HSI course sequence at two universities, one of which was the Naval Postgraduate School (NPS). He suggested using existing courses plus developing an introductory course that would cover HSI principles and methods to round out the curriculum. Booher proposed courses from Operations Research; Systems Management; Systems Engineering; and Modeling, Virtual Environments and Simulations (MOVES) (Booher, 2003).

#### **D. THE MANDATE FOR HSI**

In May 2003, the DoD Instruction 5000.2 mandated the use of Human Systems Integration in the acquisition process for all Armed Services. "The PM [Program Manager] shall have a comprehensive plan for HSI in place early in the acquisition process to optimize total system performance, minimize total ownership costs, and ensure that the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the system." According to the DoD, HSI includes the following domains: Human Factors Engineering; Manpower, Personnel, and Training; Habitability; Survivability; and Environment, Safety, and Occupational Health.

In 2004, the Naval Postgraduate School approved the country's first HSI curriculum to educate active duty military and DoD civilians to develop the competencies necessary to execute and manage HSI programs. Dr. Nita Lewis Miller, a human factors professor in the Operations Research department, organized the cross-disciplinary program to educate students in HSI using existing courses, including many that Booher had recommended in the *Handbook*. The goal of the HSI program was to produce graduates who "will recognize the human as the most valuable component in technology and weapon systems" and be knowledgeable in the eight domains of Navy HSI. The Navy domains are Human Factors Engineering; Manpower, Personnel and Training; System Safety; Human Survivability; Habitability; and Health Hazards. The Educational Skill Requirements (ESRs) that were initially established for the program included: data

analysis; research design; human performance; modeling; organizational behavior; system acquisition; manpower, personnel, and training; environment and safety; and professional military education (NPS Academic Catalog, 2007). The full text of the ESRs can be found in Appendix A.

Currently, the Chief of Naval Personnel (CNP) is developing an instruction to guide Navy HSI work. The Navy's initial and now defunct approach to an HSI program was called The Systems Engineering, Acquisition, and Personnel Integration (SEAPRINT). The SEAPRINT document would have identified the nature and procedures of HSI work. Using the MANPRINT management principles and technical program as a framework, SEAPRINT sought to improve the Navy's human modeling. The program would have addressed improved job performance and reduced total ownership costs, integrated manpower and personnel tools, and institutionalized and standardized HSI methodologies and modeling tools. SEAPRINT identified seven actionable tenets: 1) initiate HSI early, 2) identify issues/plan analysis, 3) document/crosswalk HSI requirement, 4) make HSI a factor in source selection, 5) execute integrated technical process, 6) conduct proactive trade-offs, and 7) conduct HSI milestone assessments.

The original spirit of the work was to describe a complete, standardized Navy HSI program while integrating ongoing initiatives such as capabilities-based approach, streamlined acquisition, Sea Power 21, and the Five Vector Model (5VM) (Narkevicius & Owen, 2006). Today Sea Power 21 and the 5VM are being reviewed to determine their usefulness to the Navy. As of spring 2007, SEAPRINT was replaced with Navy Personnel Human Systems Integration (NAVPRINT) and is in draft form in OPNAVINST 5310.23. With a complete NAVPRINT instruction and program, the competencies required for HSI will become more defined.

## **E. THE CREATION OF HSI BILLETS**

The Naval Officer Subspecialty System (NSS) matches educational and experience requirements to the competencies required by personnel to execute these Navy billets. The NSS does this by assigning subspecialty (SSP) codes to officers who

have completed graduate education (or have substantial proven work experience) that satisfies the educational skill requirements (ESRs) agreed upon by the curriculum sponsor. The NSS matches officers to billets that require specialized competencies. In most cases, establishing an SSP also requires the Naval Postgraduate School (NPS) to develop a curriculum supported by ESRs to prepare officers to execute the work of the Navy in SSP-coded billets (Jones, 2006).

In June 2005, the Navy identified and assigned the 4600 SSP code to 84 billets. The billets spanned three officer communities and 14 designators, which included: Surface Warfare, Human Resources (HR), Aviation Support, Aviation Pilot, Limited Duty Officer (LDO), Medical Service Corps (MSC), and Supply Corps (Billets Coded for HSI 4600, Personal Correspondence, 2007). By June 2007, only 45 HSI billets remained. The HSI billets for the entire Staff Corps Community had been eliminated along with those for eight designators. Five of the eliminated designators fell within the Unrestricted Line Community (URL) while one designator, Submarine Warfare, was added. The majority of the eliminated HSI billets included requirements for Pilots and Naval Flight Officers (NFOs), Aerospace Engineering Duty Officers, MSC Officers, Supply Officers and the LDO. The rationale for the HSI billet reduction is beyond the scope of this research.

In May 2007, N1 Chief of Naval Personnel (CNP) representative Wayne Wagner expressed concern that HSI graduates in the Human Resources designator were being sent to 4600P-coded billets at Human Performance Centers (HPCs) that did not require HSI work (W. Wagner, personal communication, May 14, 2007). While the billets require an HSI-educated officer with a 4600P SSP code, the work at the billets was not aligned to the HSI core competencies. However, this conclusion was reached without conducting a formal study. This research seeks to provide a baseline understand of the current HSI billet structure and the work performed in these billets.

Today, NPS supports the HSI billet base through an HSI curriculum. The initial billet base is currently under a zero base review. The review has raised the question of what Navy work is supported by officers who possess competencies achieved through the

HSI ESRs. At first glance, the domains of HSI are broad and not central to any one Navy organization, presenting a dilemma for resource sponsors and billet allocations.

This research examines the work requirements of the 4600-coded billets and the work done by officers who have a 4600 SSP code. To examine work requirements, the *Manual of Officer Manpower and Personnel Classifications, Volume I*, also known as NAVPERS 15839I, was examined for the classifications given to officers that describe the nature of the work. The work descriptions per the Navy Officer Billet Classification (NOBC) codes provided an initial job analysis. Officers in 4600 billets or with 4600 SSP codes were asked about the nature of the work, the HSI domains they utilize, and which of the ESR competencies they need. By examining the stated work requirements, the actual work performed, and the competencies required, this research is a basic needs analysis, provides insight into the existing HSI billet structure, and exposes deficiencies in the current structure.

## **II. LITERATURE REVIEW**

### **A. INTRODUCTION**

The first part of the literature review provides an overview of the Naval Officer Classification Structure: billets, designators, subspecialty (SSP) codes, Navy Officer Billet Classifications (NOBCs), and Additional Qualification Designations (AQDs). By examining these qualities in the Human Systems Integration (HSI) billet structure, this research focused on possible inconsistencies and recommends improvements.

The second part of the literature review examines the requirements for HSI in the work environment and the classroom. Though the Department of Defense (DoD) Instruction 5000.2 mandated HSI in the acquisition process in 2003, the Navy is still constructing an HSI instruction while the Army has been implementing HSI since the 1980s. To illustrate the HSI work requirements in the military, the Army's Manpower and Personnel Integration (MANPRINT) program was used as a benchmark.

The graduate education requirements are documented in the Educational Skill Requirements (ESRs), which the curriculum sponsor and other stakeholders establish. The ESR requirements influence coursework and the competencies that the graduate attains. Ideally, the ESR competencies should support the work requirements of the billets.

### **B. OFFICER CLASSIFICATION STRUCTURE**

#### **1. A Billet: Requirements, Authorizations and End-strength**

Navy work requirements are based on the Navy standard work week (a set number of hours depending on shore or sea duty) resulting in unconstrained (without consideration of cost or personnel supply) manpower requirements. The manpower requirements state the minimum number of personnel and the skills required during either peace or wartime. Once the work requirements are funded they become an authorization, also known as a billet. Ideally, billets exist after a requirement is authorized and total end-strength is funded to support sufficient personnel inventory to fill the billets.

Personnel can only be assigned to billets and not solely to requirements (OPNAVINST 1000.16K, 2007). The 45 HSI billets examined in this study include the work requirements that are funded.

## **2. Billet and Officer Designator Codes**

Designators identify an officer's primary specialty and competitive promotion categories (NAVPERS 15839I, 2007). Designators are grouped into general categories: Unrestricted Line (URL), Restricted Line, Staff Corps, Limited Duty, and Chief Warrant. URL officers are unrestricted in their duties and can command at sea or ashore. URL officers are usually warfare-qualified and alternate between sea duty and shore duty. Examples of URL designators include Surface Warfare (SWOs), Subsurface, Aviation, and Special Operation Warfare. Restricted Line officers can command ashore but cannot command at sea. The Restricted Line officers do not necessarily rotate between sea duty and shore duty. Human Resource (HR) officers and Engineering Duty Officers (EDOs) are both of the Restricted Line and are required by over half of the 45 HSI billets. Medical Service Corps (MSC) and Nurse Corps (NC) both fall under the Staff Corps. Several MSC and NC officers have earned the 4600 SSP code.

## **3. Subspecialty Codes**

The subspecialty (SSP) process tracks graduate education and significant training and/or experience in a given field or discipline (NAVPERS 15839I, 2007). Through the Officer Master File (OMF), the community detailer, who assigns officers to billets, has access to the SSP codes assigned to individuals. The detailer uses the SSP to better match officers to billets. An officer who earns a master's degree at Naval Postgraduate School is assigned a SSP code with a "P" suffix and is required to fill a billet with the same SSP code within two shore tours following graduation.

A SSP code consists of four digits and a one character suffix. The SSP for HSI is 4600. While many suffixes are possible, the suffixes relevant to this research include "T," "P," "Q," "S," and "R." The SSP progression for graduate education and significant work experience is illustrated in Figure 1. The "T" suffix indicates that a person is in training in a master's degree program and is only applicable to personnel and not to billets. The

“P”-suffix shows that the person has earned a master’s degree in the field but does not have proven experience from filling a “P”-suffix billet. Once an officer with a “P”-suffix fills a “P”-suffix billet and satisfies the minimum time requirement of 18 months, the officer earns a “Q”-suffix to show he is a “proven subspecialist.” With a “Q”-suffix, the officer can fill billets requiring graduate education with proven experience in the field.

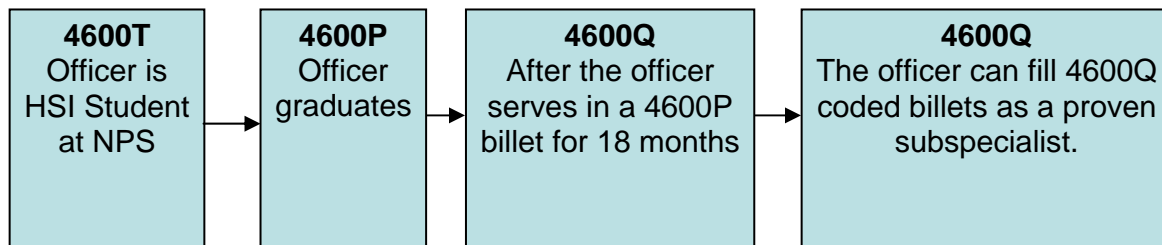


Figure 1. The SSP progression for graduate education and significant work experience

While “P” and “Q” suffixes are linked to graduate education, “S” and “R” suffixes are related to significant on-the-job training and experience as shown in Figure 2. No special requirements are needed to fill an “S” suffixed billet. Once the officer completes his tour in an “S”-suffixed billet, he earns an “S” designation indicating significant experience. If he completes 18 months in an “R” suffixed billet in the same SSP, he would earn an “R” designation. A person with an “R” or “Q” suffix has proven work experience in the related subspecialty and is a proven subspecialist (NAVPERS 15839I, 2007).

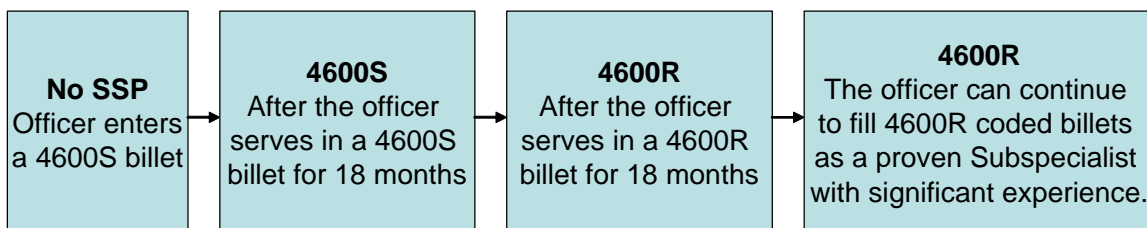


Figure 2. The SSP progression for significant subspecialist experience

#### 4. NOBC Codes

The Navy Officer Billet Classification (NOBC) process describes general occupational duties required by a billet and tracks officer experience. After an officer serves in a billet, the occupational experience is reflected through an NOBC on the officer's record. An NOBC can be earned through billet experience or through a combination of education and experience. The duties in the NOBC are not all-inclusive of the billet requirements nor are applicable to all billets. (NAVPERS 15839I, 2007).

NOBCs consist of four digits: the first digit indicates the field; the second digit identifies the group within the field; and the third and fourth digits show the specific classification within a group (See Table 1). NOBCs are entered into an officer's record to reflect the experience gained through performance in a billet or a combination of experience and related education (NAVPERS 15839I, 2007).

Table 1. Description of NOBC Digits

NOBC Digit	Description	NOBC 3950 Example	Description Example
1 <sup>st</sup>	Field	3	Personnel Field
2 <sup>nd</sup>	Group	9	General Group
3 <sup>rd</sup> and 4 <sup>th</sup>	Specific Classification	50	Personnel Research Officer

As an example, consider the Personnel Research Officer, NOBC 3950, which describes the work of twelve 4600P-coded billets (See Table 1). The 3000-3999 is the Personnel Field and consists of eight major groups. The billet duties in the Personnel Field involve overarching personnel themes such as “planning, research, and administration of the procurement, selection, classification, distribution, training, performance, separation, welfare, and records of naval and civilian personnel of the Naval Establishment” (NAVPERS 15839I, 2007). A 39XX NOBC is in the General Group, which includes billet duties related to personnel planning, direction and control that are not included in other groups. (NAVPERS 15839I, 2007). NOBC 3950 is the Personnel Research Officer and includes a detailed breakdown of the duties involved by the NOBC. “Performs or directs research in utilization of naval personnel. Conducts studies on qualification standards and billet requirements. Obtains, analyzes and

evaluates information. Develops and maintains organizational structures, requirements and command management practices. Develops coding and classification structures. Prepares billet descriptions, reports and manuals for publication. Reports on relationship of naval billets with those of other armed services and civilian agencies. Maintains information on current personnel research practices” (NAVPERS 15839I, 2007).

## 5. Additional Qualification Designation (AQD) Codes

The Additional Qualification Designation (AQD) is used to supplement the designator, SSP, and NOBC qualifications and skills. AQDs can be obtained through training and/or experience. The AQD is associated with both billets and personnel and allows for more precise matching of officers to billets in the personnel planning and detailing process (NAVPERS 15839I, 2007). At this time, no AQDs are used to identify supplementary skills of HSI.

## C. NAVAL OFFICER GRADE STRUCTURE

Naval officers compete for promotion against other officers of the same category and designator at promotion boards. The promotions from Ensign (ENS) to Lieutenant, Junior Grade (LTJG), and from LTJG to Lieutenant (LT) are not competitive and do not require promotion boards. At the first competitive promotion from LT to Lieutenant Commander (LCDR), approximately 80% of LTs are promoted depending on the community and designator and the personnel demands for the current year. Table 2 illustrates notional naval officer promotion rates and time in rank and is not intended to be precise.

Table 2. Naval Officer Grade and Rank Structure (Navy Personnel Command PERS-80, 2008)

Grade	Rank	Abbreviation	Time in Rank	Approximate Promotion Rate to next Grade
O-1	Ensign	ENS	2 years	100%
O-2	Lieutenant, Junior Grade	LTJG	2 years	100%
O-3	Lieutenant	LT	4 to 6 years	80%
O-4	Lieutenant Commander	LCDR	4 to 6 years	70%
O-5	Commander	CDR	4 to 6 years	50%
O-6	Captain	CAPT	Until retirement	N/A

Promotion boards examine the records of Naval officers and compare them with their peer group to determine which officers to promote. Boards consider many aspects of an officer's career including, but not limited to, the following: Fitness Reports (job evaluations); progression in responsibility and leadership; completion of warfare qualifications, job specific qualifications, Milestone billets, an Individual Augmentation (IA), joint tours, graduation education, and Joint Professional Military Education (JPME); and professional development within a SSP (Navy Personnel Command, 2008)

## **D. HSI DEFINITION, DOMAINS, AND BENEFITS**

### **1. Background**

Human Systems Integration is the technical and management process of analyzing and applying the eight domains of HSI to a system, which includes military systems. The eight domains are as follows: Manpower, Personnel, Training, Human Factors Engineering, System Safety, Human Survivability, Health Hazards, and Habitability (NPS Academic Catalog, 2008). The process includes examining the domains separately, determining the impact of each domain on the others, and making trade-offs between the domains to advance the well-being of the human, to increase the system performance, and to reduce the lifecycle costs. While HSI is ideally implemented from “cradle-to-grave” in systems acquisition, a system can benefit on the margin through an HSI methodology at any point in its development. Initially designed for DoD applications, the HSI process can benefit both military and civilian applications.

### **2. HSI Domains**

The DoD Instruction 5000.2, Enclosure 7, documents the DoD's view of the HSI field and the related domains. The goal of HSI is to optimize system performance, to minimize lifecycle costs, and to accommodate the user characteristics in the design. The users include operators, maintainers, and supporters. The DoD includes the following domains: Manpower, Personnel and Training; Human Factors Engineering (HFE)/Cognitive Engineering; Environment, Safety, and Occupational Health; Survivability; and Habitability. Table 3 shows the minor differences in HSI domains between the DoD, the Army, and the

Naval Postgraduate School (NPS) (DoDI 5000.2, 2003). The Navy focuses on habitability more than the Army does due to the extended deployments in a shipboard environment and related living situations for the sailors.

Table 3. The HSI Domains according to the DoD, Army, and NPS

<b>Domains</b>	<b>DoDI 5000.2</b>	<b>Army/MANPRINT</b>	<b>NPS</b>
Manpower	X	X	X
Personnel	X	X	X
Training	X	X	X
Human Factors Engineering/ Cognitive Engineering	X	HFE	HFE
Survivability	X	Soldier Survivability	Human Survivability
Environment, Safety, And Occupational Health	X	System Safety	Safety
		Health Hazards	Health Hazards
Habitability	X	none	X

The Manpower domain addresses the mix of military, DoD civilian, and contract support required for the system, taking into account cost-efficiency and effectiveness. The Personnel domain addresses the human performance characteristics that the weapon system will require and traces those back to recruiting and retention requirements. The required knowledge, skills, and abilities (KSAs) of the personnel are identified and compared with existing military occupations specialties. In the Navy, the occupational specialties are called ratings for the enlisted and designators for the officers. The Training domain examines training effectiveness, training costs, enhancement of user capabilities, maintenance of skill proficiencies, training techniques, simulation technology, and embedded training. The DoDI 5000.2 encourages training that can take place anytime and anyplace to reduce the demand on formal training. Human Factors Engineering (HFE) should be employed to improve the human-machine interfaces to reduce excessive cognitive and physical workload (DoDI 5000.2, 2003). HFE should also consider the training requirements, the likelihood of mission-critical errors, and the effects on safety and health hazards. Personnel survivability in combat examines fratricide; detection;

nuclear, biological, and chemical effects; integrity of the crew spaces; and rapid egress when the system is destroyed or severely damaged. Environment, Safety, and Occupational Health (ESOH) focuses on reducing risk by preventing and managing ESOH hazards. The Habitability domain focuses on the physical environment, personnel services, and living conditions that influence system performance. Habitability also attempts to maintain sufficient quality of life and morale so that recruitment and retention are not adversely affected (DoDI 5000.2, 2003).

### **3. The Army's MANPRINT Program, Domains, and Benefits**

While DoDI 5000.2 represents an HSI mandate, MANPRINT has been a functioning Army human systems approach for over two decades. "MANPRINT is a comprehensive management and technical program designed to improve total system (leader, unit/soldier, and equipment) performance by focusing on the human requirements for optimal system performance. This is achieved by examination of optimal allocation of total system functions and tasks to man, machine, or a combination, and to the continuous integration of Personnel Capabilities, Manpower, Training, Human Factors Engineering, System Safety, Health Hazards and Soldier Survivability considerations throughout the system acquisition process. Each consideration is called a 'domain'" (US Army MANPRINT Directorate, 2000). The Army's domains that are described differently from those in the DoD Instruction 5000.2 are briefly defined as follows:

System Safety uses design features and operating characteristics to minimize the potential for human or machine errors or failures that can lead to injuries. While safety focuses on acute injuries, Health Hazards (HH) emphasizes ongoing health risks including bodily injury or death, loud noise, chemical and biological substances, extreme temperatures, and radiation energy (US Army MANPRINT Directorate, 2000).

Throughout the design and development phases, MANPRINT ensures that: (1) system operation, maintenance, training, and support requirements are matched to personnel availability; (2) systems become increasingly user-centered, trainable, reliable, and maintainable; and (3) life cycle costs are reduced through minimizing or eliminating specialized skills and tools for user-level maintenance; and (4) total system performance is optimized at minimal life cycle costs by proper assignment of functions to man or machine (US Army MANPRINT Directorate, 2000).

## **E. EDUCATIONAL SKILL REQUIREMENTS**

### **1. Purpose**

Most NPS curricula are based on Education Skill Requirements (ESRs). The curriculum sponsor and the Subject Matter Expert (SME) determine the fundamental concepts required by graduates of a curriculum. The ESRs represent the required competencies for the related SSP billets (NPS Academic Catalog, 2007).

The Program Officers and the academic staff at NPS coordinate biennial reviews with the curriculum sponsors for each curriculum. HSI underwent such a review in FY2008. These reviews are conducted to ensure that the ESRs reflect the current competencies required by the military and anticipate the changing needs of the sponsors of each curriculum (NPS Academic Catalog, 2007). As a result of stakeholder input, the HSI ESRs have been updated and were approved in February 2008 (See Appendices A and B).

### **2. HSI ESRs**

The following HSI ESRs were taken from the Academic Catalog at the NPS website (NPS Academic Catalog, 2007) and are quoted directly. The ESRs can be found in Appendix A.

1) Data Analysis: Graduates will understand and be able to apply the statistical methods and tools necessary to perform analyses of data from HSI studies. They will have the requisite knowledge that enables successful application of these analytical methods and tools within the context and constraints of military operations or system development.

2) Research Design: Graduates will be able to investigate a problem in HSI, formulate a research question, review pertinent literature, develop appropriate data collection protocols, analyze the data appropriately, and interpret the results. Graduates will be able to apply these research principles in both field and laboratory settings. Graduates will demonstrate the ability to present research findings in written and oral format to both technical and nontechnical audiences.

3) Human Performance: Graduates will understand the basis of human performance, including human information processing, perception, cognition, decision making, and motor control. Graduates will understand

current theory and practice in assessing cognitive factors that affect human performance such as attention, memory, situation awareness, stress, fatigue, and motivation. Graduates will understand current scientific knowledge of factors affecting human performance and human error.

4) Modeling: Graduates will be able to apply HSI principles to human modeling capabilities and human-in-the-loop simulations. They will demonstrate the capability to apply human modeling techniques to analyses of military systems development and effectiveness.

5) Organizational Behavior: Graduates will understand the political, organizational, social, and economic issues associated with integrating human-machine systems into organizational cultures and environments.

6) System Acquisition: Graduates will understand and be able to apply the basic principles of defense acquisition.

7) Manpower, Personnel and Training: Graduates will understand the importance of properly assessing, screening, selecting, training, and integrating the human into military systems. This process includes understanding the empirical basis for recruitment, selection and classification, training, and retention of personnel. Graduates will understand current and emerging technologies that contribute to personnel success and performance, such as automation, training systems technologies, and job aids.

8) Environment and Safety: Graduates will acquire a thorough understanding of the environmental factors that influence human performance, effectiveness, and safety in the high stress and hazardous environments commonly encountered in military operations. Graduates will acquire the knowledge and skills necessary to analyze environmental and safety issues for their impact on systems effectiveness and personnel safety.

9) Professional Military Education: Students will be encouraged to complete the JPME program. This sequence develops an understanding of war fighting within the context of operational art. Topics include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint multinational forces and integration at the operational level of war. JPME includes coursework in war gaming designed to develop an appreciation of the art of war (NPS Academic Catalog, 2007).

The HSI ESRs emphasize data analysis, research design, and modeling as methods to analyze and integrate the HSI domains particularly within the field of system

acquisition. Organizational behavior provides insight into how to communicate with the community of interest and how to manage and implement the changes that HSI requires. The HSI program and the provisional ESRs used in this research underwent a curriculum review in FY2008. The ESRs approved in February 2008 are given in Appendix B.

## **F. HYPOTHESIS**

NPS HSI graduates attain critical analytical skills through education in the competencies established in the relevant ESRs, which results in the 4600P SSP upon graduation. To become a proven subspecialist with a “Q” suffix, the HSI graduate needs to occupy a 4600P-coded billet to earn a 4600Q SSP. However, the current 4600 billets and corresponding NOBCs may not reflect the competencies of an HSI-educated officer while other existing billets may do so. Furthermore, the current billet structure may not best execute career progression in either the SSP or existing grade structure. This research addressed the hypothesis that the work requirements of the July 2007 data set of 4600P-coded billets did not properly represent the HSI competencies as developed through the ESRs; not all Navy HSI work was identified by a 4600 SSP; and the 4600 billet structure did not allow sufficient career progression opportunities.

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### **III. METHOD**

#### **A. INTRODUCTION**

This research addressed the hypothesis that the work requirements of the July 2007 data set of 4600P-coded billets did not properly represent the HSI competencies as developed through the ESRs; not all Navy HSI work was identified by a 4600 SSP; and the 4600 billet structure did not allow sufficient career progression opportunities.

To examine the utilization of the HSI ESRs in HSI billets and by officers with a 4600 SSP, the NOBCs were examined for key words representing HSI competencies. The specified NOBC work was compared to the ESR competencies developed through HSI curriculum courses. Additionally, a questionnaire was administered to officers serving in 4600P billets and to officers who had a 4600 SSP code. The questionnaire asked them about the nature of the work using the NOBC key words, the HSI domains used, and the competencies (ESRs) required. The questionnaire results provided incumbent data on the use of the HSI domains and ESRs. By including officers with the 4600P and 4600S code, the data also pointed to whether some other billet positions in the Navy may utilize HSI knowledge, skills, and abilities. Additionally, these officers showed the disconnect between the education/work experience and billet requirements.

To evaluate sufficient career path opportunities, the billet data set was analyzed for paygrade distribution and the allocation of SSP suffixes.

#### **B. PARTICIPANTS**

The officers in the data set possessing a 4600 SSP or filling a 4600-coded billet were sent the questionnaire shown in Appendix C. The population included the following: 12 from Human Performance Center (HPC), 12 from SPAWAR, 26 from the Medical Service Corps (MSC), and 23 from other organizations for a total of 73. The HPC billets required a 4600P educated officer; however no HPC billet was filled by an officer with HSI graduate education. Ten of the 12 SPAWAR billets required an HSI educated officer while two billets were 4600S-coded. Two SPAWAR members possessed a 4600S subspecialty and were filling a 4600P billet. No SPAWAR officers had HSI

graduate education. All MSC in the population possessed a 4600P, 4600S, or 4600R code. No MSC officer filled a 4600-coded billet. The members from other organizations either were filling a 4600-coded billet or had earned a 4600 code. None of the three participants with a 4600P code filled a 4600P billet. Eight participants filled a 4600P billet not located at either HPC or SPAWAR. No officers had obtained a “Q” suffix through graduate education and significant experience. (See Table 3)

Table 4. Subspecialty of Participants by Organization

<b>Subspecialty</b>	<b>HPC</b>	<b>SPAWAR</b>	<b>MSC</b>	<b>OTHER</b>
<b>4600P</b>	0	0	0	3
<b>4600Q</b>	0	0	0	0
<b>4600S</b>	0	2	12	0
<b>4600R</b>	0	0	0	0
<b>No 4600 SSP</b>	10	5	0	8
<b>Totals</b>	10	7	12	11

Contact information was obtained from the Navy/Marine Corps White Pages at the online NPS phone directory and from the Navy/Marine Corps Intranet (NMCI) Global Directory. Members were contacted via e-mail. Of the 73 officers in the population, ten members had bad contact information, were filling an Individual Augmentation (IA) assignment, had full mailboxes and could not be reached, or had left Naval service. Of the remaining 63 members, forty participants responded to the questionnaire for a response rate of 55% of the population or 65% of the contactable population.

The response rate was further analyzed by SSP suffix and organization or designator as shown in Tables 5 and 6. Out of the 40 people with 4600 SSP, 17 responded for a response rate of 43% as shown in Table 4. Of the 17 respondents, 14 had obtained “S” codes while three had earned “P” codes. The “S” coded respondents included 12 MSC officers and two EDOs. The MSC officers were primarily Aerospace Experimental Psychologists, a unique community beyond the scope of this research. The “P” coded respondents included three HR officers.

Table 5. Response Rates of Participants by 4600 SSP

SSP suffix	# in Population	# Responded	Response Rate
“S”	32	14	44%
“R”	1	0	0%
“P”	7	3	43%
<b>Total</b>	40	17	43%

In Table 6, the response rates are shown by organization or designator. Ten of 12 HPC members participated for a response rate of 83% while seven of 12 SPAWAR members responded. Out of the medical community, 12 of 26 responded yielding a 46% response rate. Twenty-two people represented other organizations; 50% of that group participated. The overall response rate was 55%.

Table 6. Response Rates by Organization/Designator

Organization/Designator	# in Population	# Responded	Response Rate
<b>HPC</b>	12	10	83%
<b>SPAWAR</b>	12	7	58%
<b>MSC</b>	26	12	46%
<b>Other</b>	22	11	50%
<b>Total</b>	72	40	55%

## C. EQUIPMENT

### 1. Billets and Personnel 4600 SSP Data Sets

The 4600 SSP billet set containing 45 billets was received in July 2007 from the HR Officer Community Manager. The set identified each billet by Command, Ship Name, Homeport, Rank, Designator, primary NOBC, secondary NOBC, primary SSP, and secondary SSP.

The billet data set was examined by SSP suffixes, paygrades, organizations, designators, and general NOBC groupings. Key words were extracted from the NOBCs to represent the nature of the required work and were used to form a questionnaire.

The personnel data set included all officers with a 4600 SSP code along with their current billet assignment and officers filling 4600-coded billets. The officers with a 4600 SSP in the personnel data set had “S,” “R,” “T,” and “P,” suffixes. The “T” personnel

were eliminated from the population because they are still receiving HSI education at NPS. Except for two 4600S EDOs filling 4600P billets at SPAWAR, no officer with a 4600 SSP filled a 4600 billet.

## **2. Skills Derived from NOBCs**

The data set was first sorted by billet and 4600 SSP code, and then sorted by Navy Officer Billet Classifications (NOBCs) to evaluate the skills required by the work (See Appendix D). Key words pertaining to HSI ESR competencies were compared to the NOBCs, effectively comparing the work requirements with the educational requirements. The NOBC primary skills and the ESRs were compared to the domains of Human Systems Integration (HSI) to estimate the relationships between the required work, the education received, and the overarching field of HSI.

A “needs analysis” using a similar methodology stemmed from an NPS review of the Manpower Systems Analysis (MSA) program and the comparison of that program and its ESRs to the MSA billet structure (Hatch, 2004). A needs analysis examines work requirements used to determine the education required to develop the knowledge, skills, and abilities to support the competencies for work requirements.

To supplement the NOBC descriptions, a questionnaire was sent to incumbents in the 4600-coded billets and 4600 SSP coded officers to evaluate the types of work being performed and required competencies. The primary skills, work performed, and competencies of 4600-coded billets were compared to the NPS HSI curriculum ESRs. A comparative qualitative analysis between 4600-coded billet NOBCs and the domains of HSI practitioners was conducted. The questionnaire asked the participants about the nature of their work. The questions and response choices were selected from the NOBC key words, the ESRs, and the HSI domains (See Figure 3). Additionally, the participants identified their billet type, designator, rank, and SSP code.

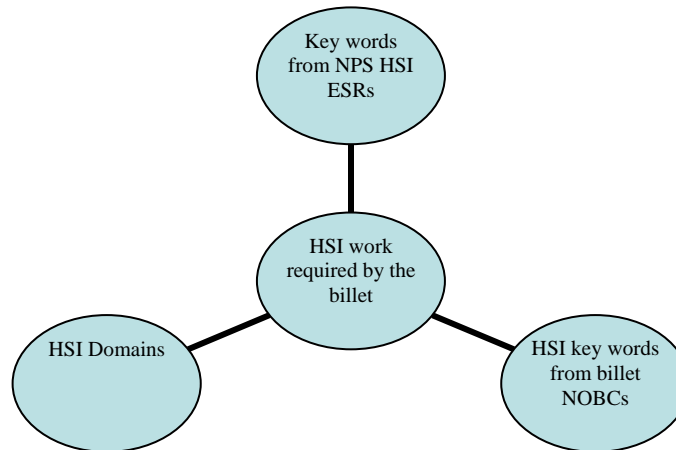


Figure 3. HSI Work Requirements by ESRs, NOBCs, and HSI Domains

### 3. Question Selection for the Questionnaire

Questions were selected to investigate the hypothesis that work requirements the July 2007 data set of 4600P-coded billets did not properly utilize the HSI competencies as developed through the ESRs; not all Navy HSI work was identified by a 4600 SSP; and the 4600 billet structure did not allow sufficient career progression opportunities.

To determine whether the current 4600P-coded billets did not properly utilize the HSI ESRs, the participants were asked which competencies best reflected their current billet. The ESR key words were given as choices, although they were not referred to as ESRs on the questionnaire. The responses provided insight into the correlation between the billet work and the ESRs obtained through graduate education. If the ESRs were not well-utilized by the billets, then further research should be done to determine if other billets may better utilize the ESRs.

Because HSI billets should include work with some or all of the HSI domains, participants were explicitly asked which of the HSI domains best represented the work required by their billet. The ESRs captured certain aspects of the domains along with an overarching ESR that mentioned all the domains. The overarching nature of this ESR formed the question on the HSI domains. This question asked about work requirements

using the eight domains of Human Systems Integration (HSI) as defined by the NPS HSI program plus the domain of Environment from the DoDI 5000.2. The purpose was to find the correlation between the work and the HSI domains. The number of HSI domains represented by a billet was expected to give an indication whether HSI work was performed in the billet. If the billet required HSI, then the billet should likely keep a 4600 subspecialty code (SSP). If the billet did not use HSI, then the removal of the 4600 SSP from the billet may be recommended.

To examine whether some Navy HSI work was not identified by a 4600 SSP, the 4600-coded billets were compared to the work of other billets. In this case, the work in 4600P billets was compared to the work done by officers with the 4600S SSP but who were not filling an HSI billet. These officers were well-suited to identify HSI competencies and domains since they were familiar with HSI by virtue of their “S” code. Many of the MSC officers with the “S” code applied for it based on their education, training, and experience in billets that were not HSI-coded. If the experience in these non-HSI billets aided the MSC officers in obtaining the “S” code, then these billets may require HSI work and should be considered for the 4600 SSP. The HSI work was examined based on NOBCs, HSI domains, and ESRs.

To further determine HSI work required by the billets, participants were asked about the work routinely required by the billet. This question asked about work requirements using the requirements from the NOBCs. The purpose was to find the match or mismatch between the work and the NOBCs. A mismatch may require a different or new NOBC for the work being performed.

Career progression concerns were mainly addressed by the analysis of the billet data set. Leadership billets were identified by the number of people supervised. As shown by established Navy policy, as the officer paygrade rises, the resource responsibilities of people, money, and materiel increase. This question used the number of people supervised to correspond to the leadership and paygrade that best fit the billet.

Finally, participants were asked to provide amplifying details. This facilitated a comparison of the requirements in the billet data set and to distinguish between members

who had a 4600 SSP versus those filling a 4600-coded billet. Participants were asked to provide their paygrade, designator, billet title, subspecialty code, length of time in billet, and any amplifying information.

The full questionnaire is available in Appendix C.

#### **D. PROCEDURES**

The participants were sent the one page questionnaire via e-mail along with a request to fill out the form electronically and return it via e-mail. The data from the returned questionnaires were entered into an Excel spreadsheet. The participants placed an X next to items corresponding to their work. The Excel spreadsheet was imported into JMP, a SAS-based statistical software package, for statistical analysis.

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## **IV. DATA AND RESULTS**

### **A. ANALYSIS OF EXISTING BILLETS**

#### **1. 4600 Suffixes**

##### ***a. Results***

The July 2007 billet data set was analyzed and sorted by subspecialty (SSP) suffixes. It included 41 primary SSP observations, with “P” suffixes, and four secondary SSP observations, all “S” suffixes. No billets in the data set were assigned the “Q” or “R” “proven” subspecialist suffix. The fifty-two 4600 SSP officers in the personnel data set (July 2007) had the following breakdown of 4600 suffixes: 12 “T,” eight “P,” 31 “S,” and one “R.” The data file did not reflect any officers with the “Q” suffix. It is assumed that the relative infancy of the Naval Postgraduate School (NPS) Human Systems Integration (HSI) program accounts for why no “Q” coded officers showed up in the data file.

##### ***b. Discussion***

Without “Q” billets, the billet structure does not support a career progression for HSI educated officers. The current structure allows an HSI educated officer to earn a 4600Q designation by filling a “P” billet. Typical SSP progression has “Q” coded officers filling a more demanding “Q” coded billet once proven in a “P” coded billet.

It appears that the HSI billet structure lacks a career progression related to receiving on-the-job experience as indicated by “S” and “R” coded billets. Only four “S”-coded billets exist and two of those are at the senior officer level. HSI billets requiring on-the-job experience (“S”- and “R”- suffixed billets) can help meet the demands for HSI in the acquisition process and supplement the HSI educated officers. The personnel data set is not aligned with the billet structure with 31 “S” SSP officers. Most of the officers with the “S” SSP are Staff Corps, including the Medical Service Corps (MSC). A discussion with an Aerospace Experimental Psychologist (AEP) Officer disclosed that

AEP officers, who are MSC officers, received the 4600S SSP by applying for the SSP based on education and experience. However, no 4600S billets exist for Staff Corps officers to fill. As of June 2005, 13 of 84 proposed HSI billets required MSC officers, but none of these MSC billets were found in the July 2007 data set.

## **2. Officer Categories**

### ***a. Results***

The data contained three officer categories: Unrestricted Line (URL), Restricted Line, and Staff Corps. The July 2007 billet data set showed billets from the URL (8) and the Restricted Line (33). The July 2007 personnel data set consisted of the officers who had a 4600 SSP: seven officers from the URL, nineteen from the Restricted Line, and 26 from the Staff Corps. An analysis of the June 2007 data set showed that only two officers with a 4600 SSP were filling 4600-coded billets. The two officers were EDOs with a 4600S SSP and were filling 4600P billets.

### ***b. Discussion***

The July 2007 billet structure only called for URL and Restricted Line officers even though more than 20 MSC officers have earned an “S” designation and two have earned a “P” designation. The billets should be aligned to reflect the competencies of the Staff Corps in addition to the URL and Restricted Line. Given that several domains of HSI are in the realm of the MSC, the MSC community should be examined for HSI SSP relevancy. Because MSC officers possess significant education when they enter the Officer Corps and are not well-represented at NPS, “S” and “R” coded billets should be considered in addition to “P” and “Q” coded billets. This on-the-job experience allows the MSC officer to bring domain expertise into an HSI perspective.

## **3. Organizations**

### ***a. Results***

The July 2007 billet data set represented 12 Navy organizations. These organizations included Human Performance Center (HPC); Space and Naval Warfare Systems Command (SPAWAR); Naval Sea Systems Command (NAVSEA) and

associated Program Executive Offices (PEO); Naval Safety Center; Commander, Naval Installations Command (CNIC) and Commander, Naval Region (CNR); Chief of Naval Personnel (CHNPERSUP); Commander, Military Sealift Command (COMSC); U.S. Naval Academy; Naval Support Activity (NSA); Chief of Naval Operations (OPNAV); and Personnel Support Activity (PSA).

The HPC and SPAWAR each owned 12 billets while CNR/CNIC had six billets, NAVSEA had four billets, the Naval Safety Center had two billets, PEO had two billets, and the remaining organizations had one billet each. HPC billets were assigned Human Resource (HR) officers while the SPAWAR billets required Engineering Duty Officers (EDOs). Acquisition community billets included two PEO billets related to Integrated Warfare Systems and Submarines.

#### ***b. Discussion***

After the HPC is eliminated and the SPAWAR billets are removed from the 4600 SSP, 10 Navy organizations will be represented. Of these, only four will have more than one billet. Despite NPS HSI graduate education focusing on the defense acquisition process, the billets did not reflect this priority. Both PEO billets are “S” coded and do not require graduate education. One PEO billet required an O-6 Surface Warfare Officer (SWO) while the other required an O-4 Submariner. The complete lack of 4600P billets in the acquisition community shows a mismatch between the ESRs and the billet structure. Based on the Acquisition ESR, the acquisition community may have billets that would benefit from an HSI educated officer and should be investigated further.

While NAVSEA has four billets and six when the PEO billets are included, the numbers seem disproportionate to the size of the organization and the scope of HSI-related responsibilities. NAVSEA manages more than 150 acquisition programs and has a force of 53,000 civilian, military, and contract support personnel. NAVSEA engineers, builds, buys, and maintains the Navy’s ships, submarines, and the related combat systems. As a Provider Command, NAVSEA directs resources from resource sponsors into the mix of manpower and materiel to equip the fleet (<http://www.navsea.navy.mil/>). The functions appear highly related to the HSI ESRs and

the NAVSEA community should be scoured for more opportunities for HSI interaction. The HSI billets may be at the five affiliated Program Executive Offices or at the individual program level depending on the mix of military and civilian HSI practitioners.

Surprisingly, Naval Air Systems Command (NAVAIR) is not represented by the HSI billet data. NAVAIR focuses on acquisition, research and development, test and evaluation, and support capabilities for airborne weapons systems (<http://www.navair.navy.mil/>). Like NAVSEA, NAVAIR has a large acquisition focus but with the emphasis on airborne weapons instead of seaborne weapons. Some of the Human Factors Engineering and other HSI domain work is performed by the Aerospace Experimental Psychologists (AEP), many of whom have successfully applied for a 4600S SSP based on their experience and education. The AEP community could benefit by having 4600 “S” and “R” coded billets to show the experience progression on HSI issues. Additionally, the NAVAIR community should be examined for “P” and “Q” billets to support the acquisition process.

SPAWAR was represented by 14 billets in the July 2007 data set. Its mission is to “invent, acquire, develop, deliver, and support integrated and interoperable C4ISR, business IT and space capabilities in the interest of national defense” (<http://enterprise.spawar.navy.mil/body.cfm?type=c&category=18&subcat=1>). SPAWAR holds membership in the Naval Acquisition Enterprise, has 7,550 employees, and exercises technical authority in support of three PEOs. The functions of SPAWAR appear to be related to several HSI ESRs: human-machine interaction, acquisition, and application of human performance issues.

#### **4. Paygrades**

##### ***a. Results***

The billet data set included officers ranging from LTJG to Captain. A breakdown of officer grades and SSP suffixes is shown in Table 7. Forty-one billets required the “P” suffix while four were identified with the “S” suffix. Of the “P” billets,

32 were at the O-3 and O-4 level, corresponding to the paygrade of most officers graduating from NPS. One “P” billet required an O-2, and no billets required the “Q” suffix.

Of the four “S” billets, two were at the O-4 level while two were at the senior officer (O-5 and O-6) level. No “R” requirements existed, which makes it impossible for an officer with an interest in HSI from time served in his “S” coded billet to progress to the “R” designation, which indicates significant subspecialist experience.

Table 7. Billet Requirements by Officer Grade and SSP suffix

Paygrade	“P”	“Q”	“S”	“R”	Totals
O-6	5	0	1	0	6
O-5	3	0	1	0	4
O-4	15	0	2	0	17
O-3	17	0	0	0	17
O-2	1	0	0	0	1
Totals	41	0	4	0	45

***b. Discussion***

The paygrade distribution does not fully align with the Navy structure. An O-2 “P” billet is required, but an O-2 typically has only two to four years of Naval service. The HSI curriculum is two years and is typically completed several years into an officer’s career. Thus an O-2 is unlikely to have HSI graduate education. Eight “P” billets required senior officers at the O-5 and O-6 levels. Senior officers have substantial Naval experience with typically more than 18 years of service. “P” requirements are intended as an initial follow-on shore tour for an NPS graduate to supplement education with experience. By the time the senior officer level is reached, the officer would likely have completed the initial “P” shore tour and have earned a “Q” code designating significant experience and graduate education. However, no billets require the “Q” suffix, which prevents SSP career progression.

## 5. Billets and Personnel Inventory

### a. Results

The billet data set consisted of requirements for Surface Warfare Officers (SWOs), Aviation Officers, Human Resources (HR), Engineering Duty Officers (EDOs), and general requirements for line officers with a warfare qualification and officers regardless of warfare qualification. The designators in the billet data set are shown in Table 8. Four of the “P” billets could be filled by any designator regardless of community or warfare qualification (1000 coded). These billets were located at CNR and NSA. One “P” billet required an O-6 warfare qualified officer (1050 billet) as the NAVSEA Deputy Director of HSI. Three “P” billets were for Surface Warfare Officers, which included positions at NAVSEA, OPNAV, and the Naval Academy. Two “P” billets were for aviators, including the 1300 and 1312 designators, and included billets at the Naval Safety Center. Thirty-one “P” billets were for restricted line officers including 19 for HR officers and 12 for EDOs. Twelve of the 19 HR billets were at the HPC while four were at CNR and one each at CHNPERSUP, COMSC, and PSA. All 12 “P” EDO billets were at SPAWAR. The four “S” billets called for two EDOs, one SWO, and one submariner.

Table 8. Billet Designator Codes and Suffixes

	“P”	“Q”	“S”	“R”
<i>Any Officer</i>				
<b>1000</b>	4	0	0	0
<i>URL</i>				
<b>1050</b>	1	0	0	0
<b>1110</b>	3	0	1	0
<b>1120</b>	0	0	1	0
<b>1300</b>	1	0	0	0
<b>1312</b>	1	0	0	0
<i>Restricted Line</i>				
<b>1200</b>	19	0	0	0
<b>1440</b>	12	0	2	0
<i>Totals</i>	41	0	4	0

The July 2007 personnel data set contained 52 officers with the 4600 SSP. The officers represented the MSC officers (50%), HR officers (31%), EDOs (6%), Surface Warfare Officers (12%), and Aviation Officers (2%) (see Table 9). Of the 26 MSC officers, the data showed that two had “P” suffixes, 23 had “S” suffixes, and one

had an “R” suffix. The 16 HR officers included six with a “P” suffix, five with an “S” suffix, and five with a “T” suffix. The three EDOs had “S” suffixes. The six SWOs and one aviator had “T” suffixes and are in the education pipeline to earn a Master’s of Science in HSI. The “T” suffix is assigned to officers who are enrolled in a graduate level education program. After the officer earns the master’s degree, the “T” suffix is updated to reflect a “P” suffix to indicate completion of graduation education.

Table 9. Personnel Designators and Suffixes

	“P”	“Q”	“S”	“R”	“T”
<b><i>URL</i></b>					
<b>1110</b>	0	0	0	0	6
<b>1310</b>	0	0	0	0	1
<b><i>RL</i></b>					
<b>1200</b>	5	0	5	0	6
<b>1440</b>	0	0	3	0	0
<b>2300</b>	2	0	23	1	0
<b><i>Totals</i></b>	7	0	31	1	13

***b. Discussion***

It appears that the 4600 SSP officer inventory does not meet the demand signal of the current billet structure. Officers with “P” suffixes only represent the HR and MSC communities even though the billets also require SWOs and Aviators. SWOs and one aviator are both in the HSI education pipeline (“T” suffix), so that mismatch may be rectified soon. After the 4600T officers graduate from NPS, they will earn the “P” suffix and build the 4600P inventory. No HSI billet requires an MSC officer even though 25% of the HSI educated population is in the MSC. If the personnel and billets are aligned, some MSC billets would require the 4600P SSP. Officers in the HR, EDO, and MSC communities possess 4600S codes. The “S” code shows that they have HSI experience and are suitable candidates to fill a follow-on “R” coded billet. However, no “R” coded billets exist for follow-on subspecialist tours.

In the July 2007 billet data set, 12 EDO billets are coded 4600P. However, no EDO students have ever been assigned the 4600T code to produce officers with the 4600P code. These EDO billets were initially coded 5300P (Electrical/Electronic Systems Engineering) and then changed to 4600P without consulting with the EDO Community

Manager. Instead Activity Manpower personnel at Charleston SPAWAR were consulted. These personnel did not have detailed knowledge of the EDO career path and the requirements imposed on EDOs. As a result, an improper demand signal was sent when the coding was changed; the graduate education quotas did not reflect this demand signal. No EDOs have the 4600P subspecialty as a result. With the removal of the 4600 SSP from the EDO billets, the NPS quotas will accurately reflect the null demand signal (R.A. Klocek, personal communication, May 20, 2008).

## **6. NOBC Functional Areas**

### ***a. Results***

The July 2007 billet data set was examined by assigned NOBCs (see Appendix D). The NOBCs were analyzed by associating them with the respective field and group (NAVPERS 15839I, 2007). The billet data showed that 35 of the 45 NOBCs fell in three groups. Twenty of 45 fell in the 3900-3999 General Group (Personnel Field); eight of 45 lay in the 3900-3999 General Group (Electronics Engineering Field); and seven of 45 were in the 5900-5999 Naval Science Group. The other 10 billets fell in four groups: four were in the 2600-2699 Management and Administrative Services Group; four were in the 9400-9499 Shore Operations Group; one was in the 8900-8999 Aviation Field (General Group); and one was in the 9200-9299 Shipboard Operations and Weapons Group

The NOBC descriptions for the general groups are quoted directly from the Manual of Navy Officer Manpower and Personnel Classifications, Volume I: Major Code Structures, NAVPERS 15839I, April 2007. The groups are listed in order according to the frequency of occurrence in the data set. The key words possibly associated with HSI are reproduced in red italics.

- 3900-3999 GENERAL GROUP (PERSONNEL FIELD)  
“Classifications in this group identify primary duties associated with overall *planning*, *direction*, and *control* of naval and civilian personnel and with *personnel* and *training* duties not specifically identified in another group.”

- 5900-5999 GENERAL GROUP (ELECTRONICS ENGINEERING FIELD) “Classifications in this group identify primary duties involving *planning, research, design and development, installation, maintenance, and repair* of electronic equipment and systems.”
- 2100-2199 NAVAL SCIENCE GROUP “Classifications in this group identify primary duties associated with *research and development* in air, surface, and subsurface warfare, and with *management* of designated *projects*.”
- 2600-2699 MANAGEMENT AND ADMINISTRATIVE SERVICES GROUP “Classification in this group identify primary duties associated with the execution of *management* functions and *administrative* operations.”
- 9400-9499 SHORE OPERATIONS GROUP “Classifications in this group identify primary duties involving port and naval *base command and operations*, harbor services to fleet, inshore undersea warfare, convoy and routing *administration*, ship-movement control and reporting, and civil affairs.”
- 8900-8999 GENERAL GROUP (AVIATION FIELD) “Classifications in this group identify primary duties associated with overall and coordinating *direction* naval aircraft and *aviation material programs*, and with aviation duties not specifically identified in another group.”
- 9200-9299 SHIPBOARD OPERATIONS AND WEAPONS GROUP “Classifications in this group identify primary duties associated with individual *ship command* and *ship operations* (except engineering operations), and with shipboard weapons systems, underwater demolition, and special weapons.”

The Naval Science Group reflected three O-6, one O-5, and three O-4. The seven billets are associated with the following designators: three EDOs, two SWOs, one Submariner, and one warfare qualified URL officer (1050). The General Group (Personnel Field) billets reflected one O-6, seven O-4, nine O-3, and one O-2 positions. The 20 billets are associated with the HR designator except for one that any officer can fill (1000 coded billet). The General Group (Electronics Engineering) billets reflect one O-6, four O-4, and three O-3 positions. All eight billets reflected EDOs. The other NOBC

groups reflected one O-6, one O-5, three O-4, and three O-3 positions. The designators included SWO, aviator, EDO, and any officer (1000 coded billet) (See Tables 10 and 11).

Table 10. NOBC Group by Rank

Paygrade	General Group (Personnel Field)	General Group (Electronics Engineering)	Naval Science Group	Other
<b>O-6</b>	1	1	3	1
<b>O-5</b>	2	0	1	1
<b>O-4</b>	7	4	3	3
<b>O-3</b>	9	3	0	5
<b>O-2</b>	1	0	0	0
<b>Total</b>	20	8	7	10

Table 11. NOBC Group by Designator

Designator	General Group (Personnel Field)	General Group (Electronics Engineering)	Naval Science Group	Other
<b>Any</b>				
1000	1	0	0	3
<b>URL</b>				
1050	0	0	1	0
1110	0	0	2	2
1120	0	0	1	0
1300	0	0	0	1
1312	0	0	0	1
<b>RL</b>				
1200	19	0	0	0
1440	0	8	3	3
<b>Totals</b>	20	8	7	10

***b. Discussion***

When the EDO billets are removed from the July 2007 data set, the General Group (Electronics Engineering) will no longer reflect any HSI billets and the Naval Science Group will have four billets assigned. The Naval Science group description captures much of the research and acquisition focus of the HSI ESRs. However, no HSI specific NOBC appears in any Group or Field.

**7. Data Assumptions and Limitations**

For the purposes of this research, the data sets were used “as is.” It is believed that many of the SSP billets were originally improperly coded. Because a needs analysis was outside the scope of this research, it was assumed that the NOBCs described the primary work being done in the corresponding billet (not the grade) and represented a first approximation of the work done. The billet NOBC descriptions formed the basis of a preliminary needs analysis. The research assumed that all 4600 “P” and “Q” coded billets were related to NPS graduate education.

The personnel data set was limited due to accuracy, transient members, and Privacy Act restrictions. The personnel data set included officers with a 4600 SSP code and who were currently filling a 4600 billet. The personnel data was assumed to accurately represent the personnel filling the 4600 billets or possessing the 4600 SSP. The data was restricted by members who had left the billet, were serving on an IA, or had separated from naval service. Inaccurate or insufficient contact information also limited the personnel data set.

**B. FINDINGS FROM THE QUESTIONNAIRE**

**1. Work Requirements by NOBC Key Words**

The questionnaire results were analyzed by the NOBC key words for the frequency of selection (See Figure 4). The key words were analyzed by all participants, participants filling 4600 billets, and participants who had 4600 SSP who were not filling 4600 billets. The analysis showed that each group selected the key words at similar rates

except the HPC officers as discussed. The data indicated that some NOBC key words were far more common than others while some were selected by few participants.

An examination of all participants indicated that the most frequently selected NOBC key words related to analysis, management, and liaison skills. Fifty percent or more of all participants selected the following key words: data analysis, management, project management, liaison, supervise/direct, quantitative/qualitative analysis, administrative, and policy analysis. The analysis key words are related to the Data Analysis HSI ESR. The management and liaison emphasis are related to the Organizational Behavior ESR. None of these key words are directly related to an HSI domain.

The results indicated high selection (>40% of all participants) of the following: research coordination, procedure development, technical reports, risk management, organizational plan, resource allocation/budgeting, and manpower requirements. These key words represent diverse aspects of Navy work. Research coordination is related to the Research Design ESR while technical reports could possibly be related to the Presentation of Research Findings ESR. Procedure development and risk management could be related to the Safety, Health Hazards, and Environment domains. Organizational plan and resource allocation/budgeting are related to the Organizational Behavior ESR. The manpower requirements selection reflects the Manpower domain and the Manpower, Personnel, and Training ESR.

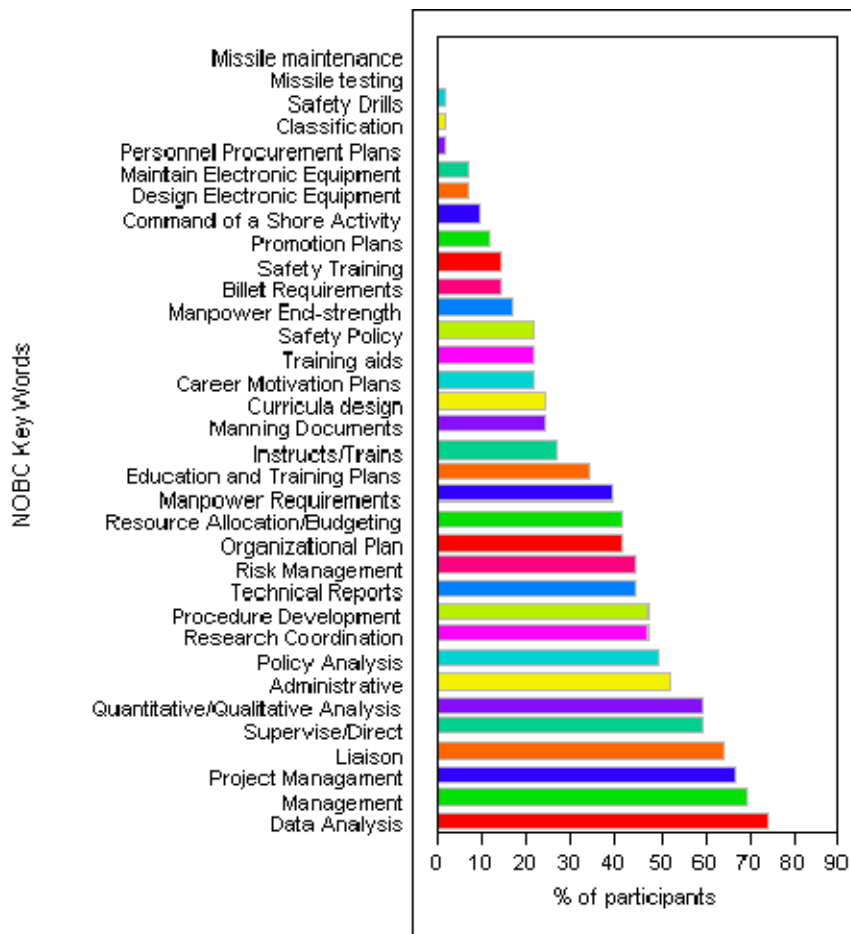


Figure 4. Percent of participants who selected each NOBC key word

HPC participants selected management (40%), supervise/direct (10%), risk management (10%), and resource allocation/budgeting (10%) key words at a much lower rate than the respondents did as a whole (70%, 60%, 45%, 42.5% overall respectively). However, 70% of HPC officers selected project management, reflecting a focus on projects vice supervision of personnel or materiel.

NOBC key words that related to more specialized work were selected at a lower rate than those related to more general work such as management. Seven NOBCs were selected by less than 10% of the respondents. These NOBCs included design of electronic equipment, maintain electronic equipment, personnel procurement plans, classification of personnel, safety drills, missile testing, and missile maintenance.

## 2. Domain Utilization

The questionnaire results indicated that Manpower, Personnel, and Training (MPT) were the most utilized domains along with Human Factors Engineering (HFE) (See Figure 5). Fewer than 20% of the participants selected safety, human survivability, environment, health hazards, or habitability. No domain was selected by more than 50% of the participants.

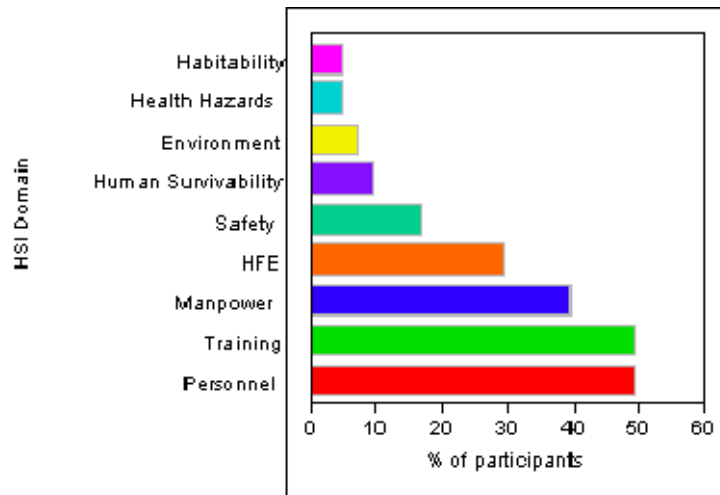


Figure 5. Percent of participants who utilize each HSI domain

Most billet work represented three HSI domains or less (See Table 12). Four or more domains were selected by 12.5% of respondents, which represented the MSC community and the SPAWAR and Naval Academy organizations. The SPAWAR billet represented command of a shore activity and the domains of manpower, personnel, human factors engineering, and safety. The MSC billet that reflected seven domains represented a military director while the one with six domains represented a director of operations. The SPAWAR billet reflecting four domains and the two MSC billets reflecting six or seven domains were all filled by O-6 personnel. One MSC billet reflected four domains and was filled with an O-4 in the role of an Aviation Experimental Psychologist. The Naval Academy billet was a leadership and law instructor position at the O-3 paygrade.

Table 12. Number of domains selected per participant by organization

# of domains selected	% overall	%MSC	%SPAWAR	%HPC	%OTHER
9	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0
7	2.5	8.3	0.0	0.0	0.0
6	2.5	8.3	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
4	7.5	8.3	14.3	0.0	9.1
3	20.0	25.0	0.0	20.0	27.3
2	32.5	33.3	0.0	50.0	36.4
1	27.5	16.7	57.1	30.0	18.2
0	7.5	0.0	28.6	0.0	9.1

Three participants indicated that no HSI domains were required by their billet, including two billets at SPAWAR and one at the Program Executive Office (PEO). Over 25% of the participants selected only one domain (See Table 12). These domains included personnel, training, HFE, and safety, and the billets were located at each type of organization. Except for the SPAWAR billet for command of a shore activity, the SPAWAR billets reflected one or zero domains.

Participants who held a 4600P, a 4600S, or no 4600 SSP code were also examined by HSI domain utilization (See Figure 6). Three participants had a 4600P code and were HR officers filling HR billets that were not coded for HSI. The 4600P participants chose the MPT domains, which are central to the HR community. The 4600S participants primarily represented the MSC along with two EDO officers. The MSC officers were not filling a 4600-coded billet while the EDOs were filling 4600P-coded billets. As an aggregate, the 4600S participants selected all nine of the HSI domains. The participants without a 4600 SSP were filling either a 4600P or 4600S-coded billet; as a whole, these participants selected seven of nine HSI domains. The following six domains were selected more frequently by participants with a 4600S SSP than in a 4600 billet: training, human factors engineering, health hazards, human survivability, environment, and habitability. The following three domains were selected more frequently by participants in the 4600 billets than by the participants with a 4600S SSP: manpower, personnel, and safety. Manpower and personnel domains are heavily used at HPC along with CNR. The safety domain was utilized in billets at SPAWAR, OPNAV, and the Naval Safety Center.

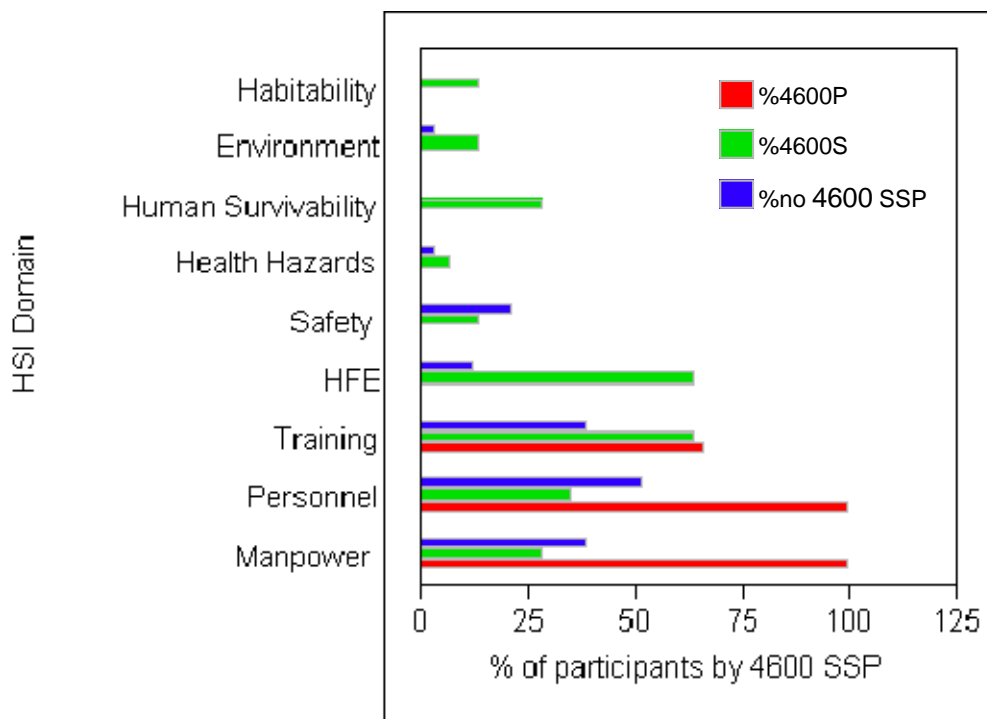


Figure 6. Percent of participants by 4600 SSP who utilize each HSI domain

The questionnaire results indicated that Manpower, Personnel, and Training (MPT) were the most utilized domains and were represented by MSC, SPAWAR, HPC, and 4600 billets at other organizations (See Table 13). The data indicated that HPC utilized MPT more than the other organizations. All 4600P billets at HPCs reflect HR officers. Manpower, Personnel, Training, and Education (MPT&E) represent primary competencies for the HR community so it follows that MPT domains would be well represented. Two-thirds of the MSC officers selected the Training domain. Many of the MSC officers worked in the Aerospace Experimental Psychology (AEP) community. The required AEP work per the NOBC (0852) (See Appendix D) includes research, investigation, and analysis related to the human-machine interaction, selection tests, training procedures, and human factors concerns related to survival, safety, and operational effectiveness (NAVPERS 15839I, 2007). This NOBC describes work

associated with the HSI domains of Personnel, Training, HFE, Human Survivability, and Safety and helps to explain why the MSC officers have a high HSI domain utilization relative to other participants.

Table 13. Percent of participants by organization who utilize each HSI domain

<b>HSI Domains</b>	<b>%MSC</b>	<b>%SPAWAR</b>	<b>%OTHER (no 4600 SSP)</b>	<b>%HPC</b>	<b>%OVERALL</b>
<b>Personnel</b>	41.7	28.6	50	60	50
<b>Training</b>	66.7	14.3	25	70	50
<b>Manpower</b>	33.3	14.3	37.5	50	40
<b>HFE</b>	66.7	28.6	25	0	30
<b>Safety</b>	16.7	28.6	37.5	0	17.5
<b>Human Survivability</b>	33.3	0	0	0	10
<b>Environment</b>	16.7	0	0	10	7.5
<b>Habitability</b>	16.7	0	0	0	5
<b>Health Hazards</b>	8.3	0	12.5	0	5

The MSC participants selected more HSI domains on average than members who were filling 4600 billets. If HSI work is considered to be done at the 4600-coded billets in the July 2007 data set, then HSI work is also likely being done at the MSC billets in the AEP community. This finding supports the hypothesis that not all Navy HSI work was identified by a 4600 SSP.

### 3. ESR Key Word Utilization

The questionnaire results showed the utilization of the ESR competencies. MPT is the most utilized ESR and was selected by 72.5% of participants (See Figure 7). This was expected from the MPT domains being the most represented domains. As suggested by NOBC key word usage, data analysis (45%) and organizational behavior (42.5%) were frequently selected (See Table 14). Forty percent of participants indicated that they applied human performance issues such as human information processing, perception, cognition, decision making, motor control, attention, memory, situation awareness, stress, fatigue, and motivation. None of the NOBC key words is directly related to the human performance issues though many key words imply the issues. For example, career

motivation plans evokes the decision making and motivation key words while curricula design suggests human information processing, attention, and memory.

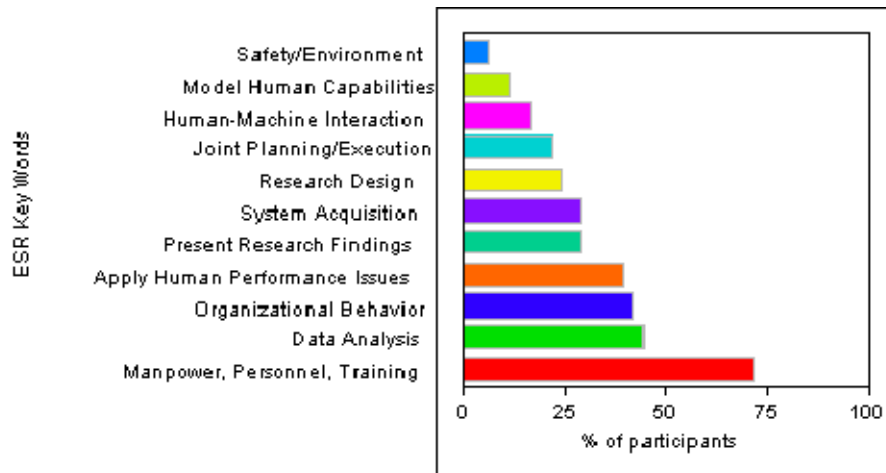


Figure 7. Percent of participants who selected each ESR key word

ESR key words were selected at different rates depending on the organization. SPAWAR was less likely to utilize MPT (28.6%) compared to average of all participants (72.5%). HPC participants selected data analysis more frequently (70%) than the combined groups (45%). MSC (58.3%) and HPC (70%) participants selected the application of human performance issues more frequently than SPAWAR (0%) or other organizations (25%). The NOBC descriptions of the work done by AEP and HPC emphasize the human so it is logical that human performance issues are applied. HPC respondents did not participate in the acquisition process (0%) while SPAWAR was quite involved (57.1%). SPAWAR participants were more likely to select joint planning and execution (57.1%) than the overall group (22.5%). MSC selected the human-machine interaction (41.7%) more frequently than the overall group (17.5%). The AEP NOBC specifically mentions the human-machine interaction, so it follows that MSC officers would be more likely to select the human-machine interaction. Safety/Environment was selected by members from other organizations such as the Naval Safety Center but not by any other group.

Table 14. Percent of participants by organization who selected each ESR key word

<b>ESR Key Words</b>	<b>%MSC</b>	<b>%SPAWAR</b>	<b>%HPC</b>	<b>%OTHER (no 4600 SSP)</b>	<b>%OVERALL</b>
<b>Manpower, Personnel, Training</b>	83.3	28.6	100.0	50.0	72.5
<b>Data Analysis</b>	25.0	42.9	70.0	37.5	45.0
<b>Organizational Behavior</b>	25.0	57.1	60.0	25.0	42.5
<b>Apply Human Performance issues</b>	58.3	0.0	70.0	25.0	40.0
<b>Present Research Findings</b>	16.7	42.9	30.0	37.5	30.0
<b>System Acquisition</b>	41.7	57.1	0.0	37.5	30.0
<b>Research Design</b>	16.7	28.6	40.0	0.0	25.0
<b>Joint Planning/Execution</b>	16.7	57.1	0.0	25.0	22.5
<b>Human-Machine Interaction</b>	41.7	14.3	10.0	0.0	17.5
<b>Model Human Capabilities</b>	16.7	14.3	10.0	12.5	12.5
<b>Safety/Environment</b>	0.0	0.0	0.0	37.5	7.5

ESR key word selection was examined by SSP code. Participants with a 4600P code who attained the competencies of the ESRs through education at NPS selected an average of 3.6 ESRs representing six of the 11 ESRs. The selected key words included MPT, data analysis, organizational behavior, presentation of research findings, research design, and joint planning and execution. The participants with a 4600S SSP averaged 3.4 ESRs per person and represented all ESRs except for Safety/Environment. Participants filling the 4600 billets but not possessing a 4600 SSP selected an average of 3.4 ESRs while representing all 11 ESRs. HPC participants selected an average of 3.9 ESRs while officers serving in 4600 billets without a 4600 SSP selected 2.9 ESRs on average. ESRs are intended to be learned and conveyed through graduate education. Since ESRs are being utilized in the billets, the findings suggest that the personnel occupying the 4600 billets may be engaged in HSI activities.

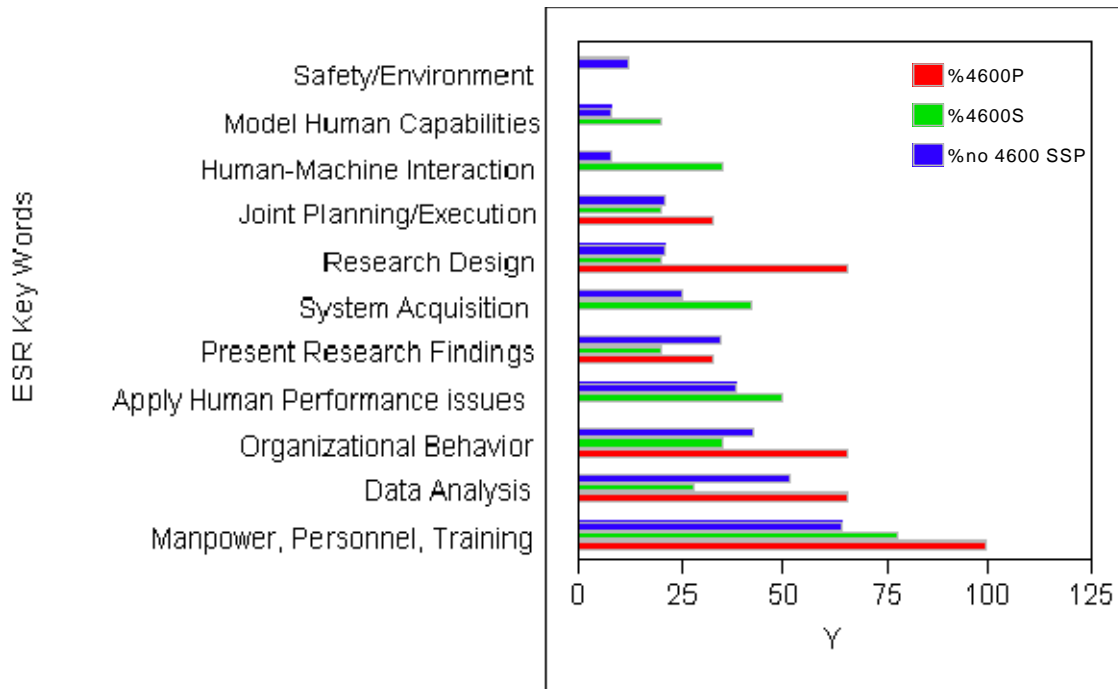


Figure 8. Percent of participants by 4600 SSP who selected each ESR key word

#### 4. Leadership Requirements

Most of the billets did not require supervision of more than 10 people. Thirty percent of participants supervised more than 10 people while only 15% of participants supervised more than 20 people. Of those supervising more than 20 people, four were O-6, one was O-5, and one was O-4. Three of the four O-6 members were from the MSC and the other was from SPAWAR. The O-5 was from SPAWAR. The O-4 had earned the 4600P and was filling an HR billet that did not have an associated 4600 SSP code.

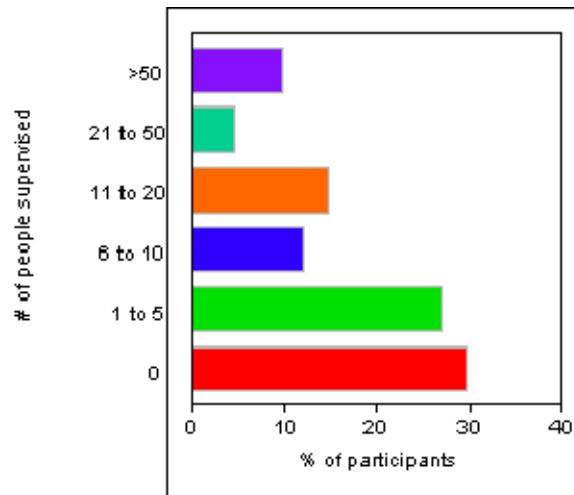


Figure 9. Percent of participants by number of personnel supervised

## 5. Overall Questionnaire Findings

An analysis of the questionnaire responses supported the hypothesis that the work of the July 2007 data set of 4600P-coded billets did not properly represent the HSI competencies as developed through the ESRs and that not all Navy HSI work was identified by a 4600 SSP.

### C. OUTLOOK FOR HSI BILLETS

The HSI billet base has undergone change since the billets were first proposed in June 2005. The original 84 proposed billets were reduced to 45 by July 2007. By September 2007, two more billets had been removed: one each at CNR and CHNPERSUP. In December 2007, the decision was made to cease funding and to disestablish the HPCs in Fiscal Year 2009. The disestablishment of the HPC removes another 12 HR 4600P billets.

The questionnaire findings provided insight into the 14 EDO 4600 billets. According to the EDO Plans and Policy Director, no EDO billet has or should ever have been coded with a 4600 SSP. The EDO billets were miscoded for HSI without consulting with the Community Manager (R.A. Kloczek, personal communication, May 20, 2008). In February 2008, the EDO community requested that the twelve 4600P and two 4600S SSP

codes be removed from the EDO billets and replaced with EDO-approved SSP requirements. In April 2008, the request was approved.

After the HPC and SPAWAR changes are made to the billet base, the HSI billets will include 15 “P” and two “S” suffixes (See Tables 15 and 16). The billets reflect the following paygrades: one O-2, five O-3, five O-4, one O-5, and three O-6. As previously discussed, the O-2 billet does not reflect normal career progression because officers do not typically receive graduate education and the related “P” suffix until the O-3 or O-4 grade. The 10 O-3 and O-4 “P” billets reflect the paygrades of most officers when they graduate from NPS. However, billet progression from that point is minimal. Only one billet is intended for an O-5 while three reflect the O-6 level. In order for HSI to be a viable subspecialty requiring graduate education, relevant HSI billets need to be identified in the Navy. The low number of HSI billets requiring graduate education limits subspecialty utilization and career progression.

Table 15. FY09 Outlook: Billet Requirements by Officer Grade and SSP suffix

Paygrade	“P”	“Q”	“S”	“R”	Totals
<b>CAPT (O-6)</b>	3	0	1	0	4
<b>CDR (O-5)</b>	1	0	0	0	1
<b>LCDR (O-4)</b>	5	0	1	0	6
<b>LT (O-3)</b>	5	0	0	0	5
<b>LTJG (O-2)</b>	1	0	0	0	1
<b>Totals</b>	15	0	2	0	17

The updated billet base reflects fewer officer designators (See Table 13). All EDO billets have been eliminated and the billets for HR officers have been dramatically reduced. Any officer can fill three of the “P” billets while one billet reflects a warfare-qualified URL officer (1050). Three “P” billets are coded for SWOs while two “P” billets reflect aviators (1300 and 1312). Six billets reflect HR officers. The “S” billets reflect one SWO and one submariner.

Table 16. FY09 Outlook: Billet Designator Codes and Suffixes

<b>Designator</b>	<b>“P”</b>	<b>“Q”</b>	<b>“S”</b>	<b>“R”</b>
<i>Any</i>				
1000	3	0	0	0
<i>URL</i>				
1050	1	0	0	0
1110	3	0	1	0
1120	0	0	1	0
1300	1	0	0	0
1312	1	0	0	0
<i>Restricted Line</i>				
1200	6	0	0	0
1440	0	0	0	0
<i>Totals</i>	15	0	2	0

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## **V. SUMMARY, CONCLUSION, AND RECOMMENDATIONS**

### **A. SUMMARY**

Though the driving force for performing Human Systems Integration (HSI) in the acquisition process can find its origin in the form of a long-standing Department of Defense (DoD) directive, only recently has a Navy graduate education curriculum for HSI been developed. Medical Service Corps (MSC) officers have been performing several HSI functions for the aviation community for some time. The literature review showed that Department of the Navy (DoN) civilians predominantly perform these HSI functions in the Navy. Human Resource (HR) officers and Engineering Duty Officers (EDOs) fill the majority of the HSI 4600-coded billets while the MSC officers possess the majority of the 4600 subspecialty (SSP) codes. HSI billets found in the Human Performance Center (HPC), System Commands (SYSCOMs), Program Executive Offices (PEOs), and other organizations are primary requirements except in two cases where they are secondary subspecialty (SSP) requirements.

This research addressed the hypothesis that the work requirements of the July 2007 data set of 4600P-coded billets did not properly represent the HSI competencies as developed through the Educations Skill Requirements (ESRs); not all Navy HSI work was identified by a 4600 SSP; and the 4600 billet structure did not allow sufficient career progression opportunities. The research results supported the hypothesis.

The research examined the 4600 SSP billet structure as of the July 2007 data set. The billets were analyzed by SSP suffixes, officer categories and designators, organizations, paygrades, billet and personnel inventories, and Navy Officer Billet Classification (NOBC) field and group. A comparative analysis of the NOBC descriptions, ESRs, and HSI domains was conducted to match work requirements and educational competencies. Billet incumbents (officers assigned to 4600-coded billets) and personnel with a 4600 SSP described their work in a questionnaire based on the NOBC descriptions, ESRs, and HSI domains. The questionnaire analysis compared the represented organizations to the work requirements, HSI domains, and competency

requirements (ESRs) as given in the questionnaire. The organizations or officer categories included Human Performance Center (HPC), Space and Naval Warfare Command (SPAWAR), other organizations with 4600-coded billets, and officers who had a 4600S or 4600P code but were not filling a 4600 billet. The officers with a 4600 SSP but not filling a 4600 billet represented the Medical Service Corps (MSC) and Human Resource (HR) community.

## **B. CONCLUSION**

The literature review and an analysis of the data sets led to several conclusions.

The HSI billets as of July 2007 did not properly utilize the ESRs and were not good job fits for the competencies of an HSI practitioner. Only three of 11 ESR key words were selected by more than 40% of 4600 billet incumbents and included the following: manpower, personnel, and training (MPT); data analysis; and organizational behavior. Five of 11 ESRs were selected by less than 25% of the billet incumbents and included the following: research design, joint planning and execution, human-machine interaction, modeling of human capabilities, and safety/environment. NPS graduate education is intended to educate students in the competencies as specified within the ESRs. These ESRs are intended to support billets coded with the 4600P code. With the low ESR utilization rates (participants chose 31% of the ESRs on average), it appears that these billets did not require most of the NPS HSI curriculum ESRs.

The billets in the July 2007 data set required few HSI domains according to billet incumbents. The billet work typically involved no more than three domains of HSI based on the NOBC description and questionnaire results. Less than 10% of participants filling 4600 billets identified as using more than three domains. Those two people included a senior officer in command of a shore activity at SPAWAR and an instructor at the Naval Academy. Fifty-three percent of billet incumbents selected two or three domains. Forty-eight percent of billet incumbents selected one domain or less. No single HSI domain was selected by more than 50% of 4600-coded billet incumbents. Billet incumbents most frequently selected the following domains: manpower (36%), personnel (36%), training (40%), and safety (20%). HSI is intended to reach across multiple domains and make

explicit the trade-offs between domains. Trade-offs between domains cannot occur when one domain or less is utilized. However, the billets that involve two or more domains and trade-off analysis may involve HSI work. The new set of ESRs emphasizes trade-off analysis (see Appendix B). The ESRs identify the HSI domains and related issues as competencies. The lack of domain utilization further supports the hypothesis that the July 2007 data set of 4600P-coded billets did not properly represent the HSI competencies as developed through the ESRs.

The data analysis suggested that not all Navy HSI work was identified by a 4600 SSP. To determine this, the work of the 4600 billets was compared with the work of the MSC officers who earned a 4600S code through on-the-job experience. The MSC officers identified their work by three HSI domains on average while SPAWAR members identified 1.1 domains on average and HPC members identified 1.9 domains on average. This data suggests that MSC officers may actually perform HSI work. MSC officers identified their work by an average of 3.4 ESRs, which was the same average as SPAWAR. However, HPC officers identified 3.9 ESRs while incumbents in other 4600 billets identified 2.9 ESRs. This suggested that MSC officers may do HSI work but further research needs to be done to determine if the competencies gained through HSI education would benefit the required work. If HSI ESRs are not required by the billets but the domains and HSI concepts are utilized, the billets could benefit from a 4600S code as a secondary requirement.

The 4600 billet structure as of July 2007 did not allow for sufficient career progression. The 4600 billet data indicated that the career progression of an HSI educated officer is limited by a lack of “Q” suffixed billets and inadequate paygrade distribution. After completing NPS, the officer earns the 4600P code. Following 18 months in a 4600P billet, the officer earns a “Q” code, which identifies a “proven subspecialist.” This qualifies the officer to fill 4600Q billets that require both education and experience. However, no 4600Q billets existed in the data set. To allow for SSP progression, 4600Q billets must be identified. Force structure inconsistencies also limited SSP career

progression. The data showed an insufficient number of LT, LCDR, and CDR billets to populate the five CAPT billets that require proven HSI graduate education. In particular, three CDR billets are intended to populate five CAPT billets, which is improbable.

Due to the infancy of the NPS HSI curriculum, the inventory of 4600P officers in the Navy is very low. Moreover, graduates of the NPS HSI program have not been assigned to 4600P-coded billets as shown through a comparative analysis of the billet data set, personnel data set, and the questionnaire responses. As a result, the 4600P-coded billets are filled by people who do not have a formal HSI graduate education, and HSI educated officers have not had the opportunity to earn a 4600Q code. The data analysis suggests that officer milestone billets take precedence over subspecialty utilization. That is, NPS graduates are assigned to milestone billets following graduation rather than to 4600P billets. This would account for the majority of officers detailed to HSI billets without the appropriate SSP and low SSP utilization rates resulting in no “Q” coded officers in the inventory.

The distribution of HSI graduates and proven specialists does not support the designator distribution. It appears that the 4600 SSP officer inventory does not meet the demand signal of the July 2007 billet structure. Officers with “P” suffixes only represent the HR and MSC communities even though the billets also require SWOs and Aviators. SWOs and one aviator are both in the HSI education pipeline (“T” suffix), so that mismatch may be rectified soon. After the 4600T officers graduate from NPS, they will earn the “P” suffix and build the 4600P inventory. No HSI billet requires a MSC officer even though 25% of the HSI educated population is in the MSC. If the personnel and billets are aligned, some MSC billets would require the 4600P SSP. Officers in the HR, EDO, and MSC communities possess 4600S codes. The “S” code shows that they have HSI experience and are suitable candidates to fill a follow-on “R” coded billet. However, no “R” coded billets exist for follow-on subspecialist tours. Billets that would benefit from a 4600R coding should be identified.

The assignment of a SSP code to the paygrade below O-3 is impractical. The typical Naval officer career path provides for graduate education at the O-3 or O-4 level. However, an O-2 billet is coded 4600P even though an O-2 would not typically have

attended the two years of graduate education required to attain the 4600P code. Thus the requirement for a LTJG with a 4600P code is unnecessary and constrains the assignment of billets.

A formal needs analysis has never been performed to match Navy work to HSI competencies. A formal needs analysis would result in a better fit of Navy work requirements and officer knowledge, skills, and abilities. For example, the NAVSEA functions appear highly related to the HSI ESRs and the NAVSEA community may have many opportunities for HSI interaction and billets. The NAVSEA HSI-related billets may be at the five affiliated Program Executive Offices or at the individual program level depending on the mix of military and civilian HSI practitioners.

The lack of a needs analysis has precluded the Navy from developing Navy Officer Billet Classifications (NOBCs) specific to HSI and more precisely defining HSI work in the Navy. A review of the Manual of Navy Officer Manpower and Personnel Classifications, Volume I: Major Code Structures, NAVPERS 15839I, April 2007, showed no concise NOBC description of HSI work in the Navy (See Appendix D). The competencies that result from the ESRs of the HSI curriculum would best represent the possible officer billet classifications.

## **C. RECOMMENDATIONS**

This research addressed the hypothesis that the work requirements of the July 2007 data set of 4600P-coded billets did not properly represent the HSI competencies as developed through the ESRs; not all Navy HSI work was identified by a 4600 SSP; and the 4600 billet structure did not allow sufficient career progression opportunities. The analysis and findings pointed to several recommendations to improve the HSI billet structure.

### **1. Change Paygrade Structure**

The billet data set showed force structure inconsistencies. The data showed an insufficient number of O-3, O-4, and O-5 billets to populate the five O-6 billets that

require proven HSI graduate education. In particular, three O-5 billets are intended to populate five O-6 billets, which is improbable.

Using nominal promotion rates of 85% from O-3 to O-4, 60% from O-4 to O-5, and 40% from O-5 to O-6, the data show that O-6 billets cannot be supported with the current paygrade structure. As shown in Table 17, about 10 more O-5 billets are needed to populate five O-6 billets and an additional 10 junior officer billets would be needed to support the O-5 billets. Alternatively, one O-6 billet could be replaced with an O-5 billet resulting in the requirement for only seven new CDR billets. A manpower planning analyst should further examine the paygrade distribution including the typical sea-shore rotation of officer designators required by the HSI billets.

Table 17. Projected Officer Supply Needed to Fill Senior Officer Billets

	LT (O-3)	LCDR (O-4)	CDR (O-5)	CAPT (O-6)
<b>Projected Officer Supply (status quo)</b>	18	30	18	7
<b>Supply needed to grow 5 CAPT</b>	25	21	13	5
<b>Supply needed to grow 4 CAPT</b>	20	17	10	4
<b><i>Actual Billet Structure</i></b>	<i>18</i>	<i>15</i>	<i>3</i>	<i>5</i>

## 2. Change 1000 Coded Billets to 1200 Coded Billets

The NOBC descriptions for the four 1000-coded billets did not match the 4600 SSP core skills but did match the 1200 HR community core skills. These NOBCs included the following: Administrative Assistant (NOBC 2605), Management Analysis and Control Officer (NOBC 2610), and Personnel/Manpower Management Officer (NOBC 3965) (See Appendix D for NOBC descriptions). By definition, any officer can fill a 1000-coded billet. These 1000-coded billets should be changed to 1200-coded billets to allow the billets to be filled by HR officers who possess the required competencies. Additionally, the 4600 SSP should be removed from these billets because the work does not represent the HSI competencies as outlined by the ESRs.

### **3. Eliminate the “P” Suffix from O-2 and Below Billets**

The billet data set showed that one of the 4600P billets reflected an O-2. An O-2 has typically had two to four years of service as a Naval officer. An O-2 does not have sufficient time to complete an NPS Master’s of Science degree while accomplishing career path milestones. Moreover, typical NPS students are O-3 and O-4. The data support eliminating the 4600P SSP from the one O-2 4600P. Future “P”-suffixed billets should reflect the O-3 and O-4 paygrades. If O-1 or O-2 billets require HSI work, the billets should be considered for a 4600S code vice 4600P code.

### **4. Institute 4600Q Coded Billets**

Senior officer billets (O-5 and O-6) requiring graduation education were codes with the “P”-suffix. For the purposes of paygrade, the billets should require a “Q”-suffix. By the rank of CDR or CAPT, an officer should have proven subspecialist experience based on the time in service and the time since completing an NPS degree. To allow for career progression in the 4600 SSP, the five CAPT 4600P-coded and three CDR 4600P-coded billets should be changed to “Q.” The resulting “Q” suffixed billets would provide officers the opportunity to progress from 4600T to 4600P to 4600Q. This billet structure would support follow-on billets and an HSI career track. Without “Q” suffixed billets, the sea/shore progression of an Unrestricted Line Officer (URL) is inhibited. Typically, a URL officer earns a master’s degree and a “P” code, returns to sea duty, and completes a tour in the SSP within two shore tours to earn a “Q” code. Following the next sea tour, the officer would fill a “Q” coded billet in the SSP and would bring significant leadership experience in addition to the “Q” level of proven subspecialist.

### **5. Create an HSI NOBC**

The Manual of Navy Officer Manpower and Personnel Classifications, Volume I, contained no clear NOBC that describes the work of an NPS HSI educated officer. To clarify the nature of the work required by 4600-coded billets, two HSI specific NOBCs are recommended: one for junior officers and one for senior officers. The junior officers would serve as analysts and researchers while senior officers would work in supervisor and liaison roles or in acquisition management. The NOBCs should include core

competencies from the HSI ESRs and the graduate education received at NPS. With HSI specific NOBCs, the work can be more clearly defined and tailored to the skillsets of an HSI educated officer. Additionally, an HSI NOBC will aid in helping stakeholders understand the work of an HSI practitioner and how HSI can serve their interests.

#### **6. Create an HSI AQD to Correspond with an HSI Certificate Course**

The personnel and billet data sets indicated that the officers being sent to the HSI program did not match the designators reflected by the July 2007 billets. In particular, while 12 EDO billets reflected a 4600P SSP code, no EDOs have attended the NPS HSI program. With the recent removal of the 4600P codes from the EDO billets, no EDOs will attend the NPS HSI program.

EDOs typically earn engineering or systems engineering degrees at NPS and do not typically have time in their career progression to return to NPS for a second degree. To allow EDOs to continue to earn an engineering master's degree and prepare them for HSI related work, an alternate to graduate education should be considered. If HSI work is done by EDO billets, then those billets could benefit from a 4600S code as a secondary SSP. To help place qualified officers into the 4600S billets, an HSI AQD could be established to track an HSI certificate program.

Currently under preliminary development by NPS HSI faculty, a four-course HSI certificate program could be offered through distance learning or while in-residence. The resident students could take the courses as clustered electives as an emphasis in their current curriculum. While an HSI certificate would not lead to a 4600 "P" or "S" suffix, an AQD could be established to track the HSI certification. Additionally, HSI billets that do not require the competencies established through the ESRs could be assigned a 4600S or 4600R coding depending on the level of HSI knowledge and experience required. Detailers could better fit the knowledgeable HSI officer to a 4600S-coded billet with an AQD.

## **D. FUTURE WORK**

### **1. Fund a Formal Needs Analysis to Determine Where HSI Work is Required**

In order to give proper depth and insight into where billets should be located, a formal needs analysis of Navy HSI work should be funded. The analysis would consist of two needs analyses by Subject Matter Experts (SMEs) traveling to HSI stakeholders and Community Managers to discuss the nature of HSI work in those communities. While this research examined the “as-is” HSI billet structure and confirmed suspicions that the initial coding of HSI billets was inadequate, future research should be conducted to examine where HSI billets should be located to best benefit the Navy.

Once billet locations and work are determined through a formal needs analysis, other issues identified in this research need to be considered by manpower experts. For example, a manpower planning analyst should further examine the paygrade distribution. The paygrade structure needs to allow for sufficient junior officers to grow the required senior officers. Senior officer billets should have the “Q” suffix to require an officer who is a proven subspecialist. HSI specific NOBCs and AQDs can be used to identify billets and place officers that require those competencies.

### **2. Analyze More Specific Career Path Options for the HSI Practitioner**

Future research should examine the career progression of the HSI practitioner. To date, at least three possibilities have been proposed: progress from a domain practitioner to an HSI practitioner; start on small-scale acquisition projects and progress to larger projects; and serve as an HSI analyst or researcher on an HSI staff and later serve as the HSI lead in charge of the HSI staff (Shattuck, 2007). The literature review revealed some possible SSP career progressions for the Naval Officer (NAVPERS 15839I, 2007).

The HSI practitioner could start a career by working as a domain practitioner and becoming an expert in one HSI domain through experience, training, and education. Later in the career, the domain expert may expand to more domains or simply move on to an HSI practitioner role. For the Navy, this model may involve education in a single domain such as Manpower and a related payback tour in a Manpower (3130 SSP) “P” coded

billet. To progress to HSI, the officer would take the HSI certificate course currently in development to earn an AQD in HSI. This process would allow the officer to fill Manpower “Q” billets or HSI related billets such as those with an “S” code and the related AQD. The officer could progress to “R” coded billets on subsequent shore tours.

Alternatively, the HSI practitioner could start on a small-scale acquisition project and complete all the HSI work on that project. Over time, the acquisition projects would increase in scope and responsibility. For the Navy, this would likely translate to an HSI-specific career path with the related graduate education requirements. To accomplish this, the 4600 SSP coded billets would have NOBCs attached that reflected the nature of the HSI work. That is, the NOBCs on the “P” billets would reflect small projects while the NOBCs on the “Q” coded billets would reflect the larger acquisition projects. The Officer Master File (OMF) would reflect the NOBCs that the officer has satisfied, which would allow detailers to improve the match between the officer and large scale acquisition projects.

As a third option, the HSI practitioner would start out as an analyst or researcher on an HSI staff and handle smaller HSI issues assigned by a senior HSI practitioner. As the officer became more experienced, he or she would move from an HSI staffer to the HSI lead on a project. The projects would then grow in size and responsibility over the length of the career. The model could work with the existing Navy system of sea/shore rotation for warfare-qualified officers. For the first shore tour following HSI graduate education, the officer would work as an HSI staffer in a 4600P-coded billet and earn a 4600Q SSP code. For the second shore tour, the officer would serve in a “Q” coded billet as an HSI lead. At this point in the career, the officer should have had sufficient leadership experience as an Executive Officer (XO) to direct HSI staffers and liaison with the Acquisition office. For subsequent shore tours, the officer would serve in a higher paygrade “Q” coded billet that represents greater levels of responsibility and influence in the Acquisition process.

## **APPENDIX A: NAVAL POSTGRADUATE SCHOOL HUMAN SYSTEMS INTEGRATION EDUCATIONAL SKILL REQUIREMENTS (JUNE 2005) (NPS ACADEMIC CATALOG, 2007)**

1. **DATA ANALYSIS:** Graduates will understand and be able to apply the statistical methods and tools necessary to perform analyses of data from HSI studies. They will have the requisite knowledge that enables successful application of these analytical methods and tools within the context and constraints of military operations or system development.

2. **RESEARCH DESIGN:** Graduates will be able to investigate a problem in HSI, formulate a research question, review pertinent literature, develop appropriate data collection protocols, analyze the data appropriately, and interpret the results. Graduates will be able to apply these research principles in both field and laboratory settings. Graduates will demonstrate the ability to present research findings in written and oral format to both technical and nontechnical audiences.

3. **HUMAN PERFORMANCE:** Graduates will understand the basis of human performance, including human information processing, perception, cognition, decision making, and motor control. Graduates will understand current theory and practice in assessing cognitive factors that affect human performance such as attention, memory, situation awareness, stress, fatigue, and motivation. Graduates will understand current scientific knowledge of factors affecting human performance and human error.

4. **MODELING:** Graduates will be able to apply HSI principles to human modeling capabilities and human-in-the-loop simulations. They will demonstrate the capability to apply human modeling techniques to analyses of military systems development and effectiveness.

5. **ORGANIZATIONAL BEHAVIOR:** Graduates will understand the political, organizational, social, and economic issues associated with integrating human-machine systems into organizational cultures and environments.

6. **SYSTEM ACQUISITION:** Graduates will understand and be able to apply the basic principles of defense acquisition.

7. **MANPOWER, PERSONNEL AND TRAINING:** Graduates will understand the importance of properly assessing, screening, selecting, training, and integrating the human into military systems. This process includes understanding the empirical basis for recruitment, selection and classification, training, and retention of personnel. Graduates will understand current and emerging technologies that contribute to personnel success and performance, such as automation, training systems technologies, and job aids.

**8. ENVIRONMENT AND SAFETY:** Graduates will acquire a thorough understanding of the environmental factors that influence human performance, effectiveness, and safety in the high stress and hazardous environments commonly encountered in military operations. Graduates will acquire the knowledge and skills necessary to analyze environmental and safety issues for their impact on systems effectiveness and personnel safety.

**9. PROFESSIONAL MILITARY EDUCATION:** Students will be encouraged to complete the JPME program. This sequence develops an understanding of war fighting within the context of operational art. Topics include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint multinational forces and integration at the operational level of war. JPME includes coursework in war gaming designed to develop an appreciation of the art of war

**APPENDIX B: NAVAL POSTGRADUATE SCHOOL HUMAN  
SYSTEMS INTEGRATION EDUCATIONAL SKILL  
REQUIREMENTS (FEBRUARY 2008) (L.G. SHATTUCK,  
PERSONAL CORRESPONDENCE, MAY 23, 2008)**

The goal of this curriculum is to educate Naval Officers of the United States Navy in Human Systems Integration. The delivery method is an in-resident course at the Naval Postgraduate School. Human Systems Integration (HSI) acknowledges that the human is a critical component in any complex system. It is an interdisciplinary approach that makes explicit the underlying tradeoffs across the HSI domains, facilitating optimization of total system performance. The graduate of this program will possess the skills necessary to function as a practitioner in HSI.

**1. HSI DOMAIN KNOWLEDGE:** Graduates will possess a thorough background in all HSI domains: Human Factors Engineering, Manpower, Personnel, Training, Environment, Safety, and Occupational Health, Survivability, and Habitability. Graduates will understand the basis for the decisions made by individual domain specialists and will be familiar with the primary approaches and techniques used by each of the HSI domains.

**2. ANALYTICAL TECHNIQUES:** Graduates will be able to perform tradeoff analysis across domains and conduct empirical analysis within the domains of human systems integration. They will be able to apply, at the right place and at the right time, these analytical methods and tools in both field and laboratory settings within the context of the defense acquisition process.

**3. MODELING and SIMULATION:** Graduates will be able to apply Modeling and Simulation (M&S) techniques to explore HSI domain tradeoffs. They will demonstrate the ability to apply M&S techniques within and across the HSI domains to facilitate the development of military systems.

**4. HUMAN PERFORMANCE:** HSI maintains that the human is a critical component in any complex system. Graduates will understand the basis of both individual and team performance in military settings including human information processing, perception, cognition, decision making, and motor control. Graduates will understand current theory and practice in assessing cognitive factors that affect human performance such as attention, memory, situation awareness, stress, fatigue, and motivation. Graduates will understand current scientific knowledge of factors affecting human performance and human error.

**5. SYSTEMS APPROACH:** Graduates will comprehend the principles and practices of the fields of PM, SE, and logistics, as related to the DoD Acquisition Lifecycle. Knowledge of HSI influences on PM, SE, and logistics will enable graduates to positively influence the DoD Acquisition Lifecycle at appropriate times and in the right manner.

**6. IMPLEMENTING HSI TRADEOFFS:** Graduates will learn techniques to develop domain level trades, impacts, and risk assessments, and the ability to negotiate and communicate to both technical and non-technical audiences. Graduates will understand the political, organizational, social, and economic issues associated with integrating human-machine systems into organizational cultures and environments.

**7. JOINT PROFESSIONAL MILITARY EDUCATION:** Students will be encouraged to complete the Joint Professional Military Education (JPME) program. This sequence of courses develops an understanding of warfighting within the context of operational art. Topics include: national military capabilities and command structure, joint and service doctrine, joint planning and execution, and joint multinational forces and integration at the operational level of war. JPME includes coursework in wargaming designed to develop an appreciation of the art of war.

## APPENDIX C: THE QUESTIONNAIRE

### Naval Postgraduate School Informed Consent Form

**Introduction.** You are invited to participate in a study entitled “A Job Analysis of Navy HSI Billets” being conducted by the Naval Postgraduate School HSI curriculum.

**Procedures.** You will complete a 10 minute questionnaire regarding the HSI work required by your billet. The questionnaire will be filled out electronically in Microsoft Word and returned by e-mail. The information will be used to analyze current HSI work required by Navy 4600P-coded billets.

**Risks and Benefits.** I understand that this project does not involve greater than minimal risk and involves no known reasonably foreseeable risks or hazards greater than those encountered in everyday life. I have also been informed of any benefits to myself or to others that may reasonably be expected as a result of this research.

**Compensation.** I understand that no tangible compensation will be given. I understand that a copy of the research results will be available at the conclusion of the experiment. The final results will be published on DTIC in the form of a NPS student thesis.

**Confidentiality & Privacy Act.** I understand that all records of this study will be kept confidential and that my privacy will be safeguarded. No information will be publicly accessible which could identify me as a participant. I will be identified only as a code number on all research forms/data bases. My name on any signed document will not be paired with my code number in order to protect my identity. I understand that records of my participation will be maintained by NPS for three years, after which they will be destroyed.

**Voluntary Nature of the Study.** I understand that my participation is strictly voluntary, and if I agree to participate, I am free to withdraw at any time without prejudice.

**Points of Contact.** I understand that if I have any questions or comments regarding this project upon the completion of my participation, I should contact the Principal Investigator, COL Lawrence G. Shattuck, 831-656-2473, lgshattu@nps.edu. Any medical questions should be addressed to LTC Eric Morgan, MC, USA, (CO, POM Medical Clinic), (831) 242-7550, eric.morgan@nw.amedd.army.mil. Any other questions or concerns may be addressed to the IRB Chair, LT Brent Olde, 656-3807, baolde@nps.edu.

**Statement of Consent.** I have been provided with a full explanation of the purpose, procedures, and duration of my participation in this research project. I understand how my identification will be safeguarded and have had all my questions answered. I have been provided a copy of this form for my records and I agree to participate in this study. I

understand that by agreeing to participate in this research and signing this form, I do not waive any of my legal rights.

By typing my name on the line below, I acknowledge that I have read this informed consent form and I agree to participate in this study voluntarily.

---

Participant's Signature

---

Date

---

Researcher's Signature

---

Date

### **A Job Analysis of Navy HSI Billets**

*This questionnaire is expected to take less than 10 minutes.*

**Consider the work routinely required by your current billet. Place an X next to all that apply.**

- |  |  |
|--|--|
| <input type="checkbox"/> Manpower Requirements               | <input type="checkbox"/> Curricula Design                    |
| <input type="checkbox"/> Manpower End-strengths              | <input type="checkbox"/> Training Aids                       |
| <input type="checkbox"/> Manning documents                   | <input type="checkbox"/> Research coordination               |
| <input type="checkbox"/> Liaison                             | <input type="checkbox"/> Quantitative and Qualitative skills |
| <input type="checkbox"/> Supervise/Direct                    | <input type="checkbox"/> Data Analyses                       |
| <input type="checkbox"/> Management                          | <input type="checkbox"/> Technical Reports                   |
| <input type="checkbox"/> Policy Analysis                     | <input type="checkbox"/> Resource Allocation/Budgeting       |
| <input type="checkbox"/> Organizational Plan                 | <input type="checkbox"/> Project Management                  |
| <input type="checkbox"/> Administrative                      | <input type="checkbox"/> Design electronic equipment         |
| <input type="checkbox"/> Command of Shore Activity           | <input type="checkbox"/> Maintain electronic equipment       |
| <input type="checkbox"/> Personnel procurement plans         | <input type="checkbox"/> Risk Management                     |
| <input type="checkbox"/> Personnel classification structures | <input type="checkbox"/> Missile testing                     |
| <input type="checkbox"/> Billet Requirements                 | <input type="checkbox"/> Missile maintenance                 |
| <input type="checkbox"/> Education and training plans        | <input type="checkbox"/> Safety Drills                       |
| <input type="checkbox"/> Career motivation plans             | <input type="checkbox"/> Safety Training                     |
| <input type="checkbox"/> Promotion plans                     | <input type="checkbox"/> Safety Policy                       |
| <input type="checkbox"/> Instructs/Trains                    | <input type="checkbox"/> Procedure development               |

**Which of the following Human Systems Integration domains best represent(s) the work required by your current billet? Place an X next to all that apply.**

- |  |  |
|--|--|
| <input type="checkbox"/> Manpower                  | <input type="checkbox"/> Health Hazards      |
| <input type="checkbox"/> Personnel                 | <input type="checkbox"/> Human Survivability |
| <input type="checkbox"/> Training                  | <input type="checkbox"/> Environment         |
| <input type="checkbox"/> Human Factors Engineering | <input type="checkbox"/> Habitability        |
| <input type="checkbox"/> System Safety             |  |

**Which competencies best reflect your current billet? Place an X next to all that apply.**

- ☐ Data Analysis
- ☐ Research Design
- ☐ Presentation of research findings
- ☐ Human Performance
- ☐ Modeling human capabilities
- ☐ Organizational behavior
- ☐ Integrating the human-machine interaction
- ☐ System Acquisition
- ☐ Joint Planning and Execution
- ☐ Manpower, Personnel, and Training
- ☐ Safety or environment issues and their impact on system effectiveness

\_\_\_\_ Application of human performance issues such as human information processing, perception, cognition, decision making, motor control, attention, memory, situation awareness, stress, fatigue, and motivation.

\_\_\_\_ Other \_\_\_\_\_

**How many people do you supervise?**

\_\_\_\_\_

**Please provide the following:**

**Paygrade (e.g., O-3):** \_\_\_\_\_

**Designator (e.g., 1200):** \_\_\_\_\_

**Billet title (e.g., PERS RSCH/HPT):**

\_\_\_\_\_

**Subspecialty code (e.g., 4600P and 3150S):** \_\_\_\_\_

**Length of time in billet (e.g., 14 months):** \_\_\_\_\_

**Amplifying information:** \_\_\_\_\_

**APPENDIX D: NAVY OFFICER BILLET CLASSIFICATIONS  
(NOBCS) REQUIRED BY 4600 BILLETS OR EARNED BY  
PERSONNEL WITH THE 4600S SUBSPECIALTY (NAVPERS  
15839I, 2007)**

**0849 AEROSPACE PHYSIOLOGIST [AERO PHYSIO]**

Promotes safety in Naval aviation through investigations and analyses of the aerospace environment's effects on the performance of flight personnel. Instructs flight personnel. Supervises operation and maintenance of physiological/water survival training devices. Serves as a hypobaric-chamber-inside-instructor/observer. Serves as an aeromedical safety officer (AMSO). Assists aircraft mishap investigation boards. Manages the RDT&E, introduction, and maintenance of new/modified aviation life support systems. Performs flying duties in operational and training flights.

**0852 AEROSPACE EXPERIMENTAL PSYCHOLOGIST [AERO X PSYCH]**

Conducts both laboratory and inflight psychological investigations of problems within the aerospace field. Investigates man-machine problems in the design and operation of airborne weapon systems and related equipment. Evaluates selection tests and training procedures. Analyzes human factor aspects of survival, safety, and operational effectiveness of airborne weapon systems.

**2155 NAVAL SCIENCES RESEARCH COORDINATOR/ADMINISTRATOR [NAV SCI RSCH]**

Coordinates or administers research in naval sciences including air, surface, undersea and amphibious warfare and naval armament. Directs planning and supervisory activities pertaining to naval sciences research program. Organizes staff and delegates responsibilities. Establishes project priorities and supervises cost estimating, budgeting and funding. Monitors research projects under contract to universities and industrial laboratories. Ensures maintenance of liaison with governmental and industrial scientists engaged in research having direct naval applicability, exchanging scientific information and technical assistance.

**2160 DESIGNATED PROJECT MANAGER [DPJ MGR]**

(For use on billets, see NOTE) Exercises executive authority over the planning, direction and control of a designated project and over the allocation and utilization of all authorized departmental resources. Prepares and submits for approval the project master plan. Applies to the project intensified management techniques, procedures, and controls as required. Makes technical, personnel and business management decisions required by the project as authorized by charter. Reports status and progress of project in accordance with instructions of the major agency to which responsible.

NOTE - Restriction on use: In the identification of billets, this NOBC shall be applied only to the billets of the managers of projects specifically established as Designated Projects in charters signed by, or approved by, the appropriate systems commander.

2161 MAJOR PROJECT MANAGER (SELECTED) [MAJ PJ MGR SEL] (For use on billets, see NOTE; for definition, see NOBC 2160)

NOTE - Restriction on use: In the identification of billets, this classification shall identify only those designated project manager billets which are specified by the Chief of Naval Operations as equivalent to major command. The incumbent is selected by board action.

2162 DEPUTY DESIGNATED PROJECT MANAGER [DEP DPJ MGR]

(For use on billets, see NOTE) Assists and advises the designated project manager in the planning, direction and control of the project and in the allocation and utilization of all authorized departmental resources. Assists in the preparation of the project master plan. Prepares status and progress reports. Exercises such executive authority as may be delegated. Assumes the duties of the project manager during the project manager's temporary absence.

NOTE - Restriction on use: In the identification of billets, this NOBC shall be applied only to the billets of the principal deputy to a designated project manager. (See NOBCs 2160 and 2161)

2163 MANAGER, DESIGNATED PROJECT FUNCTIONAL ELEMENT [MGR DPJ FE]

(For use on billets, see NOTE) Serving as a key subordinate of, and responsible to, the designated project manager. Manages or contracts for a functional element of the project such as a major component of the project system or a major phase of the development, production and support cycle. May perform major on-site duties.

NOTE - Restriction on use: In the identification of billets, this NOBC shall be applied only to billets in which the incumbent reports directly, or through the principal deputy, to the designated project manager.

2175 UNDERSEA WARFARE RESEARCH OFFICER (GENERAL) [USEA RSCH GEN]

Conducts and coordinates naval scientific research programs contributing to undersea warfare advancement. Maintains liaison with Naval Establishment and other agencies to coordinate and direct prosubmarine and antisubmarine phases of undersea warfare program in accordance with established policy. Promotes basic research in such fields as applied physics, meteorology, electronics, machinery design, and noise reduction as applied to undersea warfare equipment and techniques. Examines new data resulting from basic research to determine use in undersea warfare program.

2605 ADMINISTRATIVE ASSISTANT [ADMIN ASST]

Assists commanding officer, executive officer, or operating head of naval activity by performing administrative duties. Supervises clerical staff of unit. Routes correspondence. Assigns space. Secures and prepares budget and fiscal statements and administers controls. Maintains work-progress reports. Maintains meeting agenda and minutes. Certifies time and leave records. Prepares rosters and directory listings. Drafts special letters and reports, compiling background information required for decisions by superior officer. Directs unit concerned with maintaining fingerprint records.

2610 MANAGEMENT ANALYSIS AND CONTROL OFFICER [MGT ANAL CTL]  
[Job Code: 001245]

Directs and develops methods and procedures for improving operational efficiency and manpower utilization in naval activities, including ships and fleet staffs. Reviews activity objectives. Establishes job standards through time studies, analytical estimating, and synthesis. Studies personnel and material utilization. Develops improved work procedures. Prepares technical and administrative manuals, instructions and reports.

2690 PRINTING AND PUBLICATIONS OFFICER [PRINT&PUBS] [Job Code: 001266]

Directs and administers planning, preparation, editing, procurement, and distribution of publications in accordance with applicable regulations, policies, and standards. Analyzes and coordinates program with activity's requirements. Administers printing, publication, and distribution units, providing advice and assistance on technical factors involved in preparation of publications. Analyzes cost factors and, when necessary or more economical, procures from other sources preparation or distribution of publications.

3270 INSTRUCTOR, NAVAL SCIENCE [INST NAV SCI]

Organizes and conducts classes, lectures, demonstrations and seminars in naval science subjects. Instructs in such subjects as naval history, orientation, weapons, navigation, naval engineering, machinery, ship stability, naval justice, leadership, operations strategy and tactics, and military government. Prepares assignment sheets and lesson outlines. Operates training aids. Administers and grades examinations. Certifies course work as acceptable for credit. Recommends improvement to standard curriculum. Acts as advisor to student groups.

3290 TRAINING OFFICER [TRAINING]

Administers military and/or civilian personnel training program for naval activity. Adjusts instruction program to conform to training syllabus and manuals. Develops training curriculum. Confers with officers in charge of schools and with instructors to determine causes of failures. Directs training aids officer to supply equipment to improve instruction. Directs voluntary education program.

3943 MANPOWER PLANNING OFFICER [MPWR PLN]

Directs preparation of plans and procedures pertaining to Navy manpower requirements. Coordinates and reviews adjustments of manpower end-strengths. Ensures observance of authorized manpower ceiling. Assists in the determination of minimum quantitative and qualitative manpower requirements. Maintains liaison with commands, bureaus, offices, or activities engaged in programs or projects having manpower implications. Develops staffing criteria, guides and manning documents.

3950 PERSONNEL RESEARCH OFFICER [PERS RSCH]

Performs or directs research in utilization of naval personnel. Conducts studies on qualification standards and billet requirements. Obtains, analyzes and evaluates information. Develops and maintains organizational structures, requirements and

command management practices. Develops coding and classification structures. Prepares billet descriptions, reports and manuals for publication. Reports on relationship of naval billets with those of other armed services and civilian agencies. Maintains information on current personnel research practices.

**3965 PERSONNEL/MANPOWER MANAGEMENT OFFICER [PERS/MPWR MGT]**

Conducts or directs personnel administration and/or manpower management of a naval activity. Reviews and evaluates the activity's Manpower Authorization, ensuring that manpower requirements are accurately stated and identified by current classification codes. As directed, prepares change requests. Supervises interview and assignment of personnel. Directs preparation of personnel rosters and strength reports. Effects personnel transfers and changes in assignment and initiates requests for replacements. Provides for discharges and reenlistments. Supervises maintenance of service records. Reconciles promotion actions with authorization.

**5904 ELECTRONICS ENGINEERING OFFICER [ELX ENG]**

Directs electronics office of naval shore activity. Provides technical and engineering assistance to all elements of the activity in solution of electronic engineering problems. Directs design, installation and testing of electronic equipment. Advises on technical aspects of methods and procedures to achieve coordination between electronic and other work of activity. Ensures satisfactory and timely accomplishment of work. Provides for proper inspection of all electronics system installations. Supervises administrative functions of electronics office.

**5917 ELECTRONIC EQUIPMENT RESEARCH OFFICER [ELXEQ RSCH]**

Directs or participates in research, design, and development of electronic equipment. Analyzes design factors, and prepares integrated programs of design and development. Prepares equipment and installation design specifications. Supervises or participates in preparation of plans, specifications and drawings for electronic equipment. Assists in preparation and defense of budgetary estimates for electronics programs. Confers with representatives of systems commands, other governmental agencies and private contractors on research, design and development problems.

**5925 ELECTRONICS INSTALLATION AND MAINTENANCE PLANNING OFFICER (GENERAL) [ELX I&M PLNGEN]**

Directs and coordinates installation and maintenance planning of electrical and electronic equipment and systems. Develops or approves diagrams and plans for installation and maintenance of new equipment. Directs accomplishment of field modifications and preparation of engineering procedures and standards for installation and maintenance of gear. Reviews and takes action on alteration requests submitted by ships, aircraft and installation activities.

8995 STAFF AVIATION SAFETY OFFICER [STF AV SAF]

Provides policy guidance and direction for safety matters appropriate to particular staff. Coordinates and implements aviation safety plans, programs and regulations. Reviews accident board findings. Informs and counsels higher authority on findings of investigations, surveys and studies. Analyzes methods, practices, criteria and regulations to discover unsafe areas. Maintains intracommand, intercommand and extranaval liaison to further aviation safety effort. Informs higher authority on findings, conclusions and remedial recommendations for improving risk management.

9246 STRIKE WARFARE/MISSILE SYSTEMS OFFICER (GENERAL) [STRKWRF MISSYS]

Assists Weapons/Combat Systems officer by directing employment, operation, upkeep and maintenance of missiles (other than SAM), systems and equipment. Directs operation and maintenance of all shipboard missile armament including designation and fire control equipment, associated navigational equipment, attack aids, test equipment, telemetering equipment used in firing and controlling missiles, launchers, loading systems, and loading and launching control systems. Directs operability tests, inspects missiles, supervises repairs and alterations.

9420 OFFICER IN CHARGE, NAVAL SHORE ACTIVITY [OIC SHR ACT]

Directs operation of activity or major component thereof. Initiates and implements action required to carry out assigned mission. Ensures compliance with policies, directives, regulations and instructions from higher authority. Maintains required departmental organization to provide effective performance of activity functions, administration and training. Conducts periodic inspections to ensure operational efficiency. Promotes general welfare and morale of activity personnel.

9421 COMMANDER/COMMANDING OFFICER, SHORE ACTIVITY [CDR/CO SHR ACT]

Commands, as a Commander, Commanding Officer, or other appropriate title, a shore activity or major component thereof in accordance with law, regulations and customs of the service. Develops organizational plan to fulfill assigned mission. Establishes policies and procedures for operation and functioning of activity. Inspects to ensure efficient operation and initiates corrective action. Exercises military control and provides technical guidance for command.

9436 EXECUTIVE OFFICER, SHORE ACTIVITY [XO SHR ACT]

Represents the commanding officer in maintaining military, professional, and general efficiency of a shore activity. Enforces activity's rules, regulations and policies as determined by commanding officer. Coordinates activities of department heads. Plans procedures for training and discipline. Directs emergency and routine fire, battle, air-raid and other drills. Establishes security, safety and police regulations. Supervises assignment of personnel.

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